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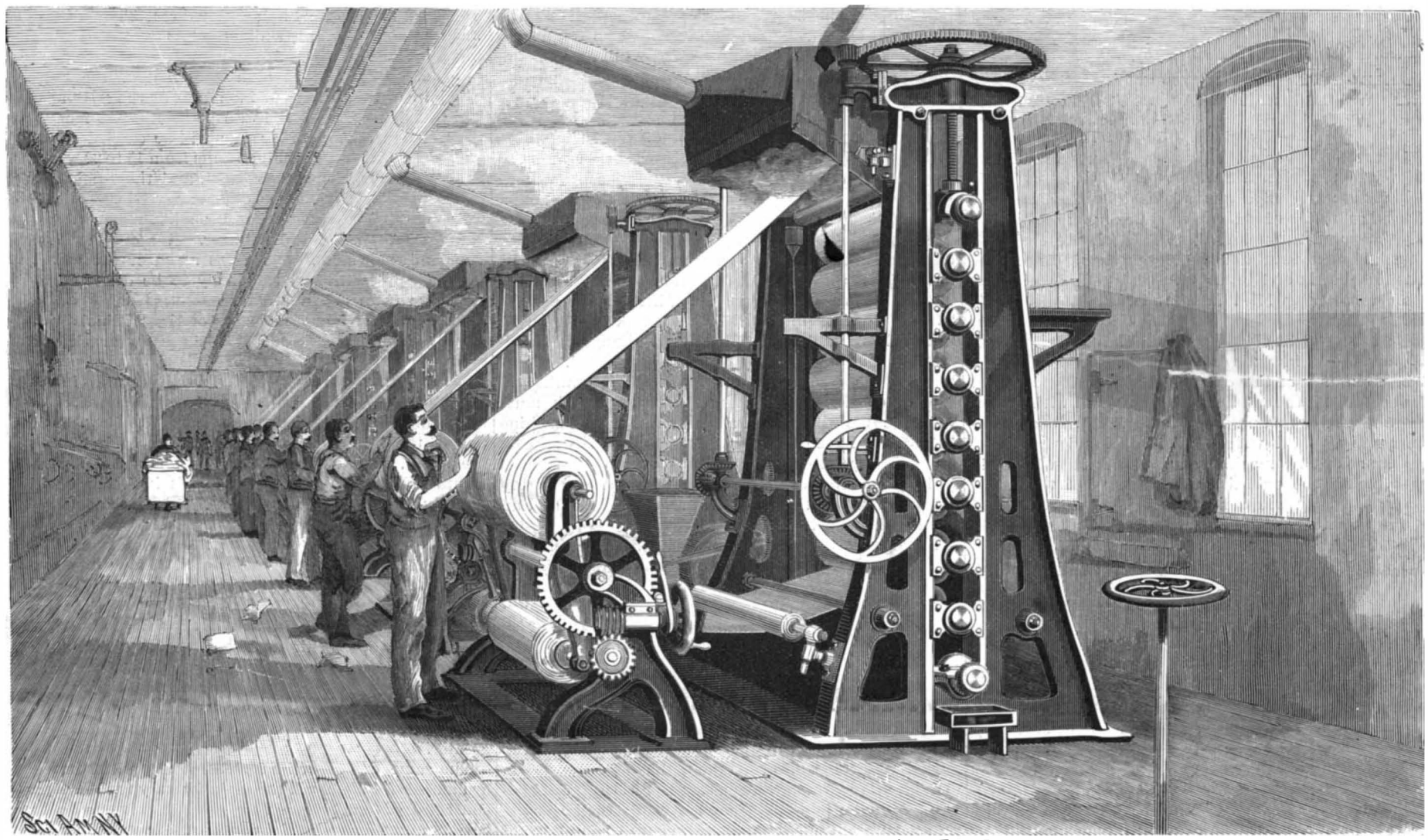
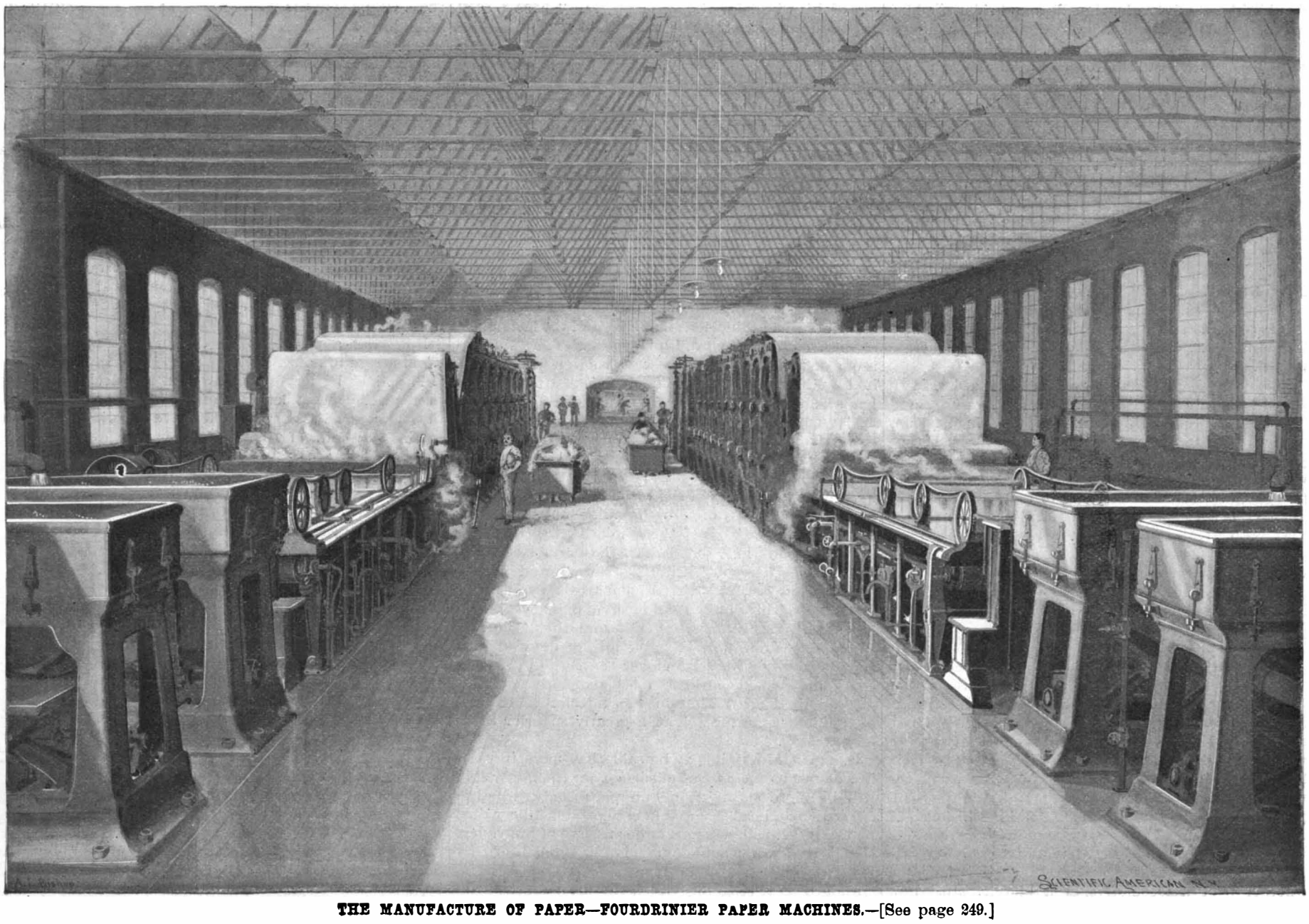


SUPER-CALENDER ROLLS FOR GIVING A HIGH FINISH TO THE PAPER.



THE MANUFACTURE OF PAPER—FOURDRINIER PAPER MACHINES.—[See page 249.]

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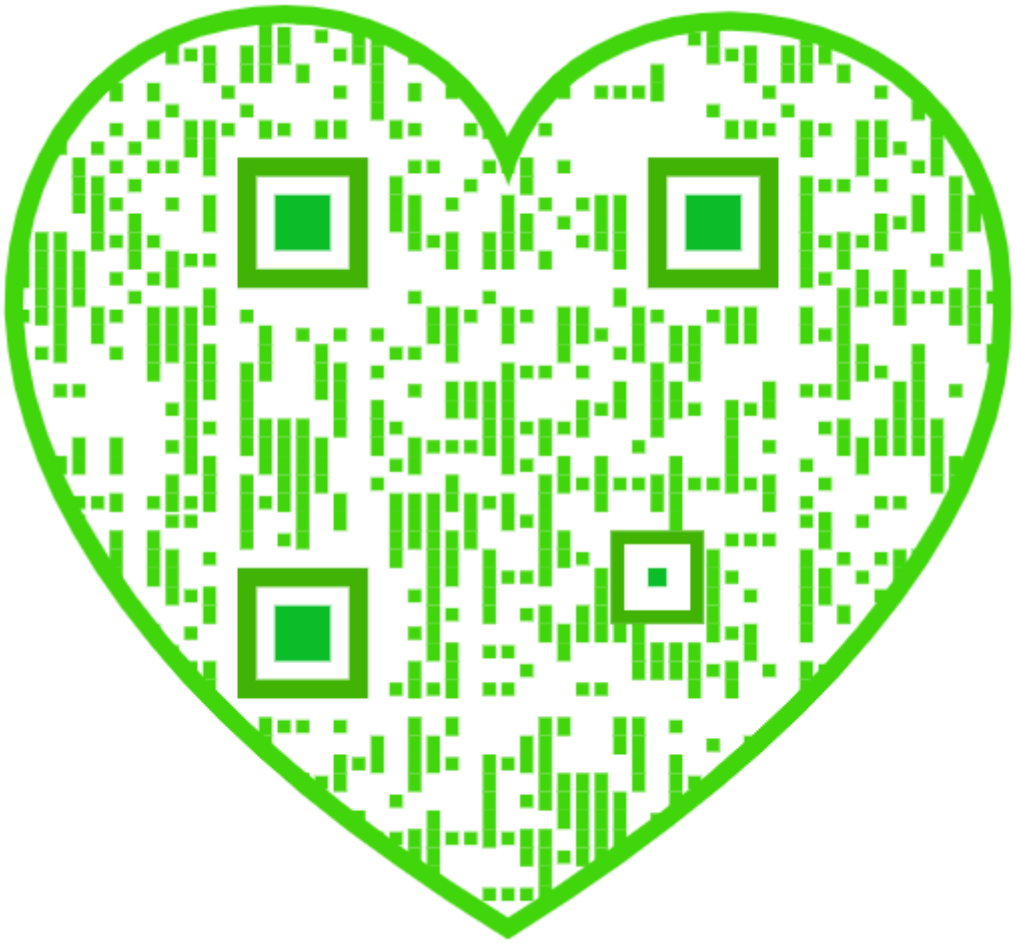

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NEW YORK, SATURDAY, OCTOBER 15, 1898.

LIGHT-WEIGHT BICYCLES.

Our recent editorial on the increasing weight of the bicycle has provoked a widely extended discussion in which the suggestions we made have been generally indorsed; although in the case of one or two contemporaries devoted to the interests of the bicycle, the statement that the weight of the bicycle should be reduced has called forth a vigorous protest. The L. A.W. Bulletin, for instance, while it admits that in 1895 wheels were ridden that weighed 20 pounds, is quite satisfied that in 1898 the weight of wheels should have risen to 28 or 20 pounds—an increase of fifty per cent in three years. The Bulletin is of the opinion that this added weight is necessary, if the public is to be provided with a thoroughly reliable mount. "Nevertheless," says our contemporary, "light weight is desirable, and the lowest weight at which a machine can be produced which will embody all the essential features is what the public want, and they will demand it and get it, as soon as some one points out how the reductions can be correctly made."

The problem of the proper weights of the bicycle is, or rather should be, dependent primarily upon the weight of the rider. If an engineer is called in by a county board to design a bridge, his first inquiry will be as to the loads the bridge must carry. The amount of metal he will put into it will be absolutely determined by the maximum loads that are liable to come upon it. If the structure is intended to carry droves of cattle, marching regiments of soldiers, or heavy traction engines, the steelwork of the bridge will weigh very much more than if it is intended to carry nothing heavier than a few foot passengers and an occasional one-horse wagon. In the case of the bicycle, however, this very elementary and obvious consideration is entirely ignored, and the same weight of wheel is provided for the 100 as for the 225-pound rider. Judged from the standpoint of scientific design, this is doing things in a very rough-and-ready, rule-of-thumb way. The light rider is taxed for the sake of the heavyweight; and it is a proposition which needs no demonstration, that if a 100 pound man is riding a wheel which will carry a 250 pound man with a proper margin of safety, he is penalized to the extent of from five to eight pounds of unnecessary weight, which he must drag over hill and dale with not the least resulting benefit to himself.

The weight of the wheel is determined, primarily, by the weight of the heaviest riders. There is not a first-class maker in the country who would hesitate to supply a 200 to 225-pound rider with a standard wheel taken from stock, for he knows that the wheel has been built to carry that load. Having built their machines to withstand the "maximum load," the makers feel perfectly secure as regards the riders of moderate weight.

In the first place, then, there should be at least two weights of machine, to secure the best results, and provide a rider with a wheel that contained no unnecessary material. If the public demanded that wheels be built to match the weight of the rider, they would be accommodated. It is more convenient and profitable to the manufacturer to turn out only one grade; but the demand for classification of wheels according to weight of rider—at least to the extent of providing two grades—would be so reasonable that it would meet with a ready response.

With wheels built according to weight, the problem of reducing weight would be greatly simplified. The manufacturer would be no longer handicapped by a "live load" of say 225 pounds, except in the case of the heavyweight wheels, the demand for which would probably not exceed twenty per cent of all the wheels sold. "Shock," to which is due most of the failures in forks and frames, results from suddenly arrested momentum, and momentum is the product of mass or weight by velocity. If the weight is reduced by from forty to fifty per cent, so is the shock to which the wheel is exposed in striking large rocks on the road, passing over badly laid crossings, or in collisions. A reduction of forty to fifty per cent in the stresses to which a machine is subjected allows a proportionate reduction in the weight and strength of that machine, whether it be a locomotive or a bicycle. Just how much reduction can be made in the case of the bicycle, in which the destructive forces at work are chiefly dynamic, could only be proved by experiment; but that it would be considerable is proved by the fact that in 1895 twenty-pound wheels, which had been put together with the conscientious care that marked the construction of the lighter and more costly wheels of that date, did carry heavy riders through a season of hard usage.

We have been asked to state in detail just where the reduction in weight could be made; we reply that the total reduction in pounds can only be gained by taking off ounces or fractions of ounces at every possible point in the wheel. We have already suggested that by increasing the height of the frame to reasonable proportions and introducing a diagonal strut, all bending strains in the plane of the frame would be eliminated, and the reinforcements of the joints could be considerably lightened without in the least impairing its strength. By returning to sprockets of reasonable diameter and cutting out of the sprockets all unnecessary metal, many ounces of weight may be saved, both in the sprockets and in the reduced length of the chain. The lighter pedal pressures, due to the use of moderate gears, would allow some slight reduction in the weight of pedals and cranks—not a great reduction, perhaps, in itself, but something that would go to make up the five or six pounds that could be taken off the present wheel. By abolishing the divided crank axle, with its heavy sleeve, and returning to crank hangers of moderate dimensions, more weight could be saved. There is a certain combined 32-tooth sprocket, cranks and axle in considerable demand just now which must weigh double what the same parts did in the machine of 1895. We have lately seen barrel hubs that were cast in the same generous mould—massive chunks of metal which, in comparison with the small and thoroughly efficient hubs of the earlier wheels, are hideous and clumsy to the last degree.

The largest saving of weight, of course, is possible in the tires. Here we tread on debatable ground, for we are well aware that there are thousands of riders who believe that anything less than a 1⅝-inch tire is a "snare and a delusion." A few years ago, it is true, the 1¼ and 1⅜-inch tires were unable to stand the test of road work; but so rapid has been the improvement in the art, that there are certain makes of light, small-diameter tires that will hold up a rider indefinitely upon the average roads which a tourist encounters.

In conclusion, we draw attention to the fact that the light but strong wheel ought to have just as much attraction for the staid tourist as for the most pronounced and wild-eyed "scorcher." To the latter the reduced weight means that, riding up to and beyond the limit of his strength, he is able to get more speed out of his wheel for the same power. To the tourist the reduced weight means that he can maintain his old gait with considerably less expenditure of power. That this gain in efficiency is desirable, no wheelman can deny, and it is equally true that the manufacturers will provide it just as soon as the riding public makes the demand.

OUR LATEST BATTLESHIP.

With the successful launching on October 4 of the "Illinois," the total number of first class battleships afloat in our navy was raised to eight. The others are the "Iowa," "Oregon," "Indiana," and "Massachusetts," which are in active service, and the "Kearsarge," "Kentucky," and "Alabama," which are nearing completion, the two former at the yards of the Newport News Shipbuilding Company, where also the launch of the "Illinois" took place, and the last named at the Cramp's shipyard, Philadelphia. The "Illinois" is one of three vessels whose construction was authorized by Congress in 1896. The other two are the "Alabama" and the "Wisconsin," the latter of which will be launched within a few weeks by her builders, the Union Iron Works, of San Francisco.

In estimating the power and all-round efficiency of the new battleship, we cannot do better than compare her with another ship of the same class with which the public has become thoroughly familiar—the "Oregon." Measured on the basis of the displacement, the "Illinois" is about 1,237 tons larger, the normal displacement of the "Oregon" being 10,288 tons, and that of the "Illinois" 11,525 tons. A comparison by displacement of two ships built at an interval of six years (the "Oregon" was authorized in 1890 and the "Illinois" in 1896) does not, however, give an adequate idea of the superiority of the later over the earlier vessel, as the improvements in the methods and materials of warship construction in the interim render the later ship, weight for weight, a greatly superior fighting machine.

In a general way it may be said that mere increase in size means increase of efficiency, for the larger ship will be more stable as a gun platform, will be less affected by a head sea, and in case of an artillery duel to the death will possess a larger reserve of buoyancy, that is to say, it would take a larger number of shot holes to sink her.

Judged as a seagoing vessel, the most marked advantage of the "Illinois" over the older ship is in her increased freeboard. The main deck in the "Oregon" is about 12 feet above the waterline, but the "Illinois" is provided with a spar deck which extends above the main deck for over two-thirds of the ship's length. This raises the freeboard to 20 feet forward and amidships and 13¼ feet aft, an increase which would enable her to steam full speed and with fairly dry decks into a sea which would roll green water over the bows and forward turrets of the "Oregon." The advantage of freeboard was noticed during the Santiago blockade, when the "Oregon," or one of her type, was steaming to Guantanamo in company with the "Texas" (a high freeboard ship) against a nasty head sea. The "Texas" was dry and buoyant, while the low freeboard vessel was plunging heavily. A further advantage resulting from lofty decks is the high command of the guns. The bore of the forward 13-inch guns of the "Illinois" will be 26½ feet above the water, as against 18 feet for the "Oregon." The other guns will be carried at the following heights: The 6-inch guns from 15 to 22½ feet, the 6-pounders from 30 to 40 feet, and the 1-pounders in the tops will be from 60 to 80 feet above the waterline. Command in a gun at sea has been likened in its advantages to "reach" in a boxer. Not only are the guns and their mounts out of the reach of the waves, but their projectiles are less likely to be deflected by striking the tops of the waves.

The protective arrangements of the "Illinois" are greatly superior. Not only does she carry armor of a greater resisting quality, but it is better disposed. The side armor of the "Oregon" only extends in the wake of the engines, boilers, and magazines, that of the "Illinois" is carried right up to the bow. The bow of the "Oregon" might be broken in by rapid-fire shells, letting water into the forward compartments and throwing the ship out of trim. This could scarcely happen to the "Illinois," whose bow at the waterline will be protected with 4 inches of Harveyized steel—sufficient to burst the shells of medium caliber on the outside of the vessel. The protective deck, moreover, will be heavier, being 2¾ inches on the flat and 3 to 4 inches on the slopes, as against a uniform thickness of 2¾ inches in the "Oregon." The heavy armor of the sides, turrets, and barbettes will be of about the same thickness as that of the "Oregon;" but as it will embody the improvements in the art of armor manufacture which have taken place in the past six years, its resisting qualities will be considerably greater.

The same degree of improvement is noticed in the armament, for although the main battery is the same, consisting of four 13-inch guns, the improvements in turrets and turret gear, in mounts and breech mechanism, are such as to greatly increase the efficiency of these weapons in the "Illinois." When we come to the secondary or intermediate armament, we are on debated ground. In the "Oregon" this consists of eight 8-inch and four 6-inch slow-fire weapons, while in the "Illinois" it is represented by fourteen 6-inch rapid-fire guns. The twelve guns of the "Oregon" are capable of about nine shots per minute, under favorable circumstances, whereas, under similar conditions, the fourteen guns of the "Illinois" could deliver between eighty and ninety shots in the same time. The destructive and crippling effect of an 8-inch shell would be enormously greater than that of a 6-inch shell, but the chances of making a hit would be 9 to 1 in favor of the rapid-fire weapons. The results at Santiago show that rapidity of fire is of prime importance, and seem to confirm the wisdom of our naval authorities in replacing the 8-inch slow-fire by the 6-inch rapid-fire guns.

But what a pity that we do not possess an 8-inch rapid-fire gun in our navy.

The 6-inch battery is disposed on two decks and is protected by a complete wall of armor 5½ and 6 inches in thickness; moreover, the effect of a bursting shell is localized by walls of 1½-inch steel which extend out from the sides of the ship between each pair of guns. Other improvements will be found in the method of supplying ammunition to the guns and in the mounting and general handiness of the guns themselves.

Taken altogether, the "Illinois" is a great advance upon the earlier ships, the only point in which the "Oregon" approaches her being that of speed. The "Oregon," on her trial trip, made 16·8 knots; the contract speed of the "Illinois" is 16 knots. As there is no speed premium attached to the later vessel, it is not probable that it will exceed, even if it equals, that of the Pacific coast vessel.

IMPORTING SONG BIRDS FOR OUR WOODS.

Humiliating as it is, the fact must be recognized that our native song birds have been so flagrantly destroyed that many varieties have become rare visitors in our woods and parks, and a few are even threatened with total extinction. The attempts to protect the birds adequately have only succeeded partly in stemming the crusade of destruction, and in no instance have these protective measures resulted in any material increase in the number of songsters. It is believed by experts that the work of killing off the birds has gone

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so far that it is quite essential that their numbers should be multiplied by some artificial means. The ordinary processes of nature are too slow, considering the great mortality that must, of necessity, obtain among birds beset by so many enemies as our native songsters are from the moment of their birth until they reach maturity.

There has, consequently, been started a movement among the bird societies of the country which promises to make a complete change in the character of our woods, fields, and parks in a comparatively short time. There has always been a large importing trade in birds in New York, and thousands of Europe's best singers have been brought to this country annually; but these canaries, bullfinches, nightingales, and linnets have all been reared for cage life. They have found their way into innumerable pleasant homes, where their singing is understood and appreciated. New York's bird importing trade has amounted to many thousands of dollars annually, and, with the steady decrease in the numbers of our native songsters, it has expanded and broadened. To-day there are some half dozen large importing houses which make a specialty of handling the song birds of Europe, while retail traders are scattered all over the country.

But now the bird importers have a new demand for their stock. From all parts of the country bird societies and private individuals are purchasing the European song birds for the purpose of restocking the woods, fields, and parks of the country with little warblers. It has been found easier to import certain foreign song birds here than to attempt to increase the numbers of native singers by artificial means. In Europe the song birds are raised on a large scale for commercial purposes, and they can be purchased in quantities cheaper than our own native birds.

Some ten years ago the question was seriously discussed, "Can the European song birds be successfully introduced and reared in this country?" The only answer to this was a practical experiment. A number of nightingales and English skylarks were imported and turned loose in Connecticut and Massachusetts. Great expectations were entertained, but the experiment was doomed to failure. The birds were seen a number of times after they were given their liberty. Then they disappeared entirely. Another lot was imported and turned loose in the northern part of New York city, but, like the first importation, the birds soon died. This was so discouraging that for a time the matter rested. It was supposed that our climate was not suited to the health of these little foreign singers.

But it was hinted by some bird fanciers that the English nightingale was about the hardest of the European songsters to acclimate, and that there were many good song birds in the Harz Mountains which might find this country a congenial home. Following this, a bird society in far-off Oregon decided to make an experiment. Mr. Frank Dekum, a public spirited resident of Portland, was president of the society, and Mr. C. F. Pfluger secretary, and together they raised enough subscriptions to purchase a large consignment of European birds. The Web Foot State has some of the finest game birds in the world, but its woods have always been barren of song birds, and it was considered quite an achievement to stock the fields and parks with song birds from Europe that the Eastern bird societies had failed to introduce.

The first consignment was a large and representative one. There were three hundred pairs of song thrushes, skylarks, goldfinches, siskins, woodlarks, black thrushes, chaffinches, crossbills, black starlings, green finches, bullfinches, robin redbreasts, linnets, singing quails, goldanners, forest finches, and both the plain and blackheaded nightingales. This large company of singers left Europe in perfect condition, but they had a rough ocean voyage, and a number of them died before they reached New York, and many others were sick and worn out. They reached their destination twenty-two days after starting from Germany. They were turned loose in the fields, woods, and parks near Portland. Beforehand, however, they were placed on exhibition in cages, and thousands of people went to visit them. Some of them, after they had rested a day or two, began to pipe and warble, and by the time they were given their liberty they were in a very tuneful condition.

Without waiting to see if this first consignment proved a failure or success, the same enterprising society had a second lot imported in the autumn of 1892. As it was considered dangerous to turn them loose just before a hard winter, this consignment of birds was wintered in a large aviary erected for them by the president of the society. The following spring they were given their liberty in the city park and the adjoining woods and grounds. The birds, upon being released, hopped about among the trees, singing and twittering joyfully. Then many of them gradually disappeared in the woods, while the finches and linnets took up their abode in the park.

The results of these two experiments were watched anxiously by bird-lovers all over the United States. If they should prove adaptable to their new home, it would be the beginning of a great movement for importing European songsters. The following summer, the birds were not only found in the woods and fields, but many of them were building nests, and before another winter came around they had more than doubled their numbers. Since then they have increased rapidly, with but few exceptions. The woods are full of singing skylarks, woodlarks, linnets, and finches. The nightingales, however, did not do well, pretty conclusively proving that the Eastern bird societies happened to select the most difficult singer to acclimate. At first the range of the imported singers was limited to the woods within a few miles around Portland, but now they have extended to neighboring counties, and the skylarks in particular are found in plentiful numbers all over the State. These birds rear from two to four broods every season, and flocks of hundreds of them can be seen any day in the fields of the Web Foot State.

Next to the skylarks, the song thrushes and woodlarks multiplied the quickest, and then followed the starlings and the goldfinches and chaffinches. The most remarkable thing about these little strangers was their migration. When the cold winters swooped down upon the State, the birds took their departure to warmer climes. In October many of them were found in California, journeying southward in flocks. Later they appeared in Southern California; then some of them were reported in Mexico, and a few of them went as far south as Central America. But as soon as spring returned they retraced their steps, and never stopped on their way to breed until they reached Oregon and Northern California. Here they built their nests near the place where they had first been given their freedom, and every summer since they have returned to their first home as regularly as our native migrants. Some of them were hardy enough to withstand the rigors of our climate, and they wintered in the dense forests of the Cascade and Coast mountain ranges.

These birds are not so high priced as the cage birds which are trained to sing certain tunes and to live comfortably in confinement. They are wild and semi-wild singers, trapped in the woods for this purpose, and shipped to this country immediately. They would not live long in confinement, nor would the cage birds live long in the woods. By ordering them in numbers, the singers can be obtained as low as $1 a pair for skylarks and woodlarks, while nightingales cost from $5 to $10 per pair. The chaffinches and goldfinches are 50 cents to $1 apiece and the bullfinches a little more.

G. E. W.

THE UNIFORM OF THE SAILOR.

In the issue of the SCIENTIFIC AMERICAN for last week the reader will find an article on the "Uniform of the Soldier" which deals with the origin of the army uniform. We will now take up briefly the consideration of the navy uniform, and for our facts we are indebted to an interesting article in The New York Sun.

In the days of the Continental Army navy blue, red, and buff prevailed, but in the navy to-day the only colors to be seen are blue, white, silver, and gold. For many years the American naval officers had their uniforms lined with either red or white, but this was abandoned before the war of 1812. The records of the Navy Department show that the first American naval uniform was authorized by the Massachusetts Council in 1776, the resolution being adopted that the uniform of the officers be green and white, and that the colors be a white flag with a green pine tree and an inscription "An Appeal to Heaven." On the 5th of September, 1776, the Marine Committee met at Philadelphia and issued an official regulation. The captain's uniform should be blue cloth with red lapels, slashed cuffs, standup collar, yellow buttons, blue breeches, and red waistcoat. A midshipman had a blue lapeled coat, cuffs faced with red, and with red at the button and buttonholes. In full dress gold lace was introduced and red was eliminated. The coats were of dark blue, with white linings and white cuffs.

In the spring of the next year there was a further change, which is noted in some manuscript papers of Paul Jones, preserved in the Library of Congress, blue coats with white linings and white cuffs, narrow white lapels, red down the whole length of the waist, and, instead of the red waistcoat and breeches, white ones were prescribed. The regulations said that gold epaulets were to be worn on the right shoulder, the figure of a rattlesnake being embroidered on the straps of the epaulets, with the motto, "Don't Tread on Me." The yellow flat buttons on the waistcoat also had the impression of the rattlesnake and the motto, "Don't Tread on Me." Various portraits of Paul Jones, Capt. Nicholas Biddle, Commodore Edward Preble, Commodore Alexander Murray, and Commodore John Barry are instructive links in the history of the evolution of the uniform, and show that the commanding officers introduced certain changes. Beginning with the order in 1830 of John Branch, Secretary of the Navy, the uniform was materially changed and further changes were introduced perhaps a dozen times before the present styles were adopted. Secretary Branch made the full dress coat of dark blue cloth lined with white. It was double breasted, with long lapels and cut with a swell; nine buttons on each lapel, which was to be buttoned back, and an equal number of buttonholes worked in twist as long in width as the lapels would allow. It had a standing collar lined with white and embroidered with gold. Two gold epaulets, faced with white, and white breeches with small naval buttons and gilt knee buttons, white silk stockings and shoes with gilt buckles completed the costume. Under these regulations epaulets were only to be used with cocked hats or caps. Lieutenants wore only one epaulet. Until the year 1839, the marines wore green coats with white or buff facings, but in that year it was changed to blue with red facings. The color has not since been altered and the members of the marine corps still wear coats of blue with red linings. The uniform of the sailors has changed as frequently as that of the officers. Up to 1835 they wore red waistcoats when in their mustering suit, but between that time and 1839 they wore blue cloth jackets and trousers and white shirts, with large blue nankeen collars and fronts trimmed with rows of white tape.

The introduction of new grades into all branches of the navy, in 1866, necessitated a reorganization of the navy uniform, which was done by Secretary Welles. At the present time the special full dress coats of all commissioned officers, except chaplains, is of dark navy blue cloth, double breasted, lined with white silk serge, the waist of the coat to descend to the top of the hip, the skirts to begin about one-quarter of the way from the front edge and descend four-fifths of the distance from the hip bone to the knee. Two buttons are on the waist behind and one near the bottom of each fold. Two rows of large naval buttons are on the breast, nine in each row, the rows being from four to five inches apart, from eye to eye at the top, and two and one-half inches at the bottom. The collar has one strap of heavy gold wire or thread lace around the top and down the front, the width varying according to rank. The frock coat is lined with black silk serge, and has shoulder attachments for epaulets.

The service coat is made to descend to the inseam of the trousers and is single breasted. The collar edges of the coat, side seams, and edges of the hip slits are trimmed with lusterless black mohair braid, one and one-quarter of an inch wide. On each side of the collar is embroidered in high relief, one inch in width, the corps badge and grade devices. The trousers are of dark navy blue cloth and have a strip of gold lace down their outer seams. Instead of the red or white waistcoat of former years, the one now worn is a dark navy blue. Gold lace ornaments are worn on the sleeves to designate the rank of the officers. They vary in width according to rank. The staff officers, except chaplains, wear the lace of their rank, but, in addition, have bands of colored cloth around the sleeve, medical officers using dark maroon velvet; pay officers, white cloth; engineer officers, red cloth; naval constructors, dark violet cloth; professors of mathematics, olive green cloth; civil engineers, light blue velvet.

On epaulets, rear admirals have two stars, with a silver foul anchor in the center; commodores have one star, with a silver foul anchor at each end; captains have a silver spread eagle in the center, with a silver foul anchor at each end; and commanders have a silver oak leaf at each end, with a silver foul anchor in the center. A gold oak leaf is used in a similar way by lieutenant-commanders, and lieutenants substitute two silver bars at each end for the leaves, while ensigns have to be content with a single foul anchor.

All commissioned officers, except chaplains, are also provided with a rigid cocked hat, made of silk beaver. The rank is distinguished by various decorations and trimmings. Of course, these hats are only used for state occasions, and the ordinary navy cap is used on shipboard.

SPANISH WOODEN BULLETS.

It is well known that Spanish soldiers in Cuba were poor marksmen, but great surprise has been expressed at the remarkable lack of execution which characterized their fire at Guantanamo and Santiago, and an officer of the United States gunboat "Montgomery" has been able to throw some light on the matter. He visited the "Maria Teresa" after the destruction of Cervera's fleet in search of souvenirs. He found a large number of Mauser cartridges in groups of five ready to go into the magazines of the guns, and, if the entire Spanish army and navy were equipped with that kind of ammunition, both Cervera and Toral were amply justified in surrendering when they did. The cartridges consisted of a metal shell loaded with hair and a sprinkling of powder. The bullet was of neither brass nor lead, but of wood. Some army contractor had imposed on the ordnance bureau of the Spanish navy, but to what extent the wooden Mauser bullets were used will probably never be known.

PENSIONS IN NEW ZEALAND.—In New Zealand a law allows a yearly pension of almost $200 to every needy and respectable person who has passed the age of 65 years and has lived for 20 years in the colony.

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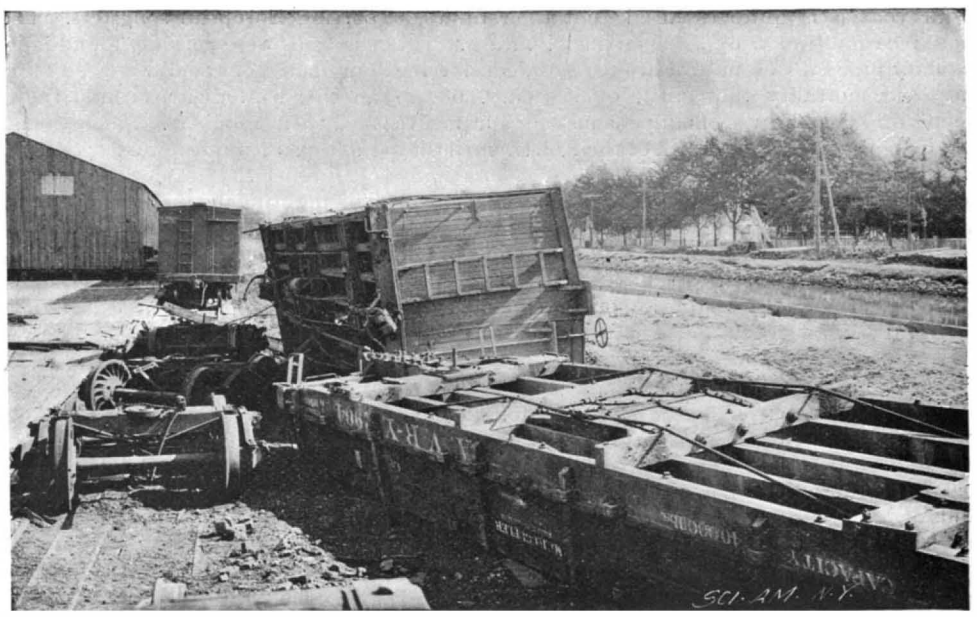
A CYCLONE IN NEW YORK STATE.

A cyclone is a horror which we are apt to consider indigenous to the West, as far as this country is concerned. Fortunately, in the East we rarely suffer from such terrible manifestations of the power of wind, but on September 26 a funnel-shaped cloud appeared out of Lake Ontario a little before 4 P. M., and, gathering force as it came from the lake, swept over the Niagara peninsula from northwest to southeast. Running parallel to the Welland Canal, it cut a swath 300 feet wide from lake to lake, and did an incredible amount of damage, besides killing five people and injuring many others. The section of the country involved includes Tonawanda, in New York State, and Merritton, in Ontario, Canada, where the damage was the greatest. In Tonawanda the tornado demolished houses, uprooted trees, overturned freight cars, and swept a clean path several hundred feet wide for a distance of ten miles. Our engraving shows some of the wrecked freight cars at Tonawanda, showing how box and coal cars were wrenched from their trucks and thrown off. Tonawanda is the great center of the lumber industry, so that naturally the damage to the lightly constructed wooden buildings was considerable. Thousands of feet of pine were swept into the river. After passing over Tonawanda, the tornado took a southeasterly course, and visited small towns further on. While crossing from Grand Island to the main shore, the tornado formed a waterspout in the Niagara River fifty feet high. As it swept east it destroyed buildings right and left; telegraph poles were demolished by the thousand.



FREIGHT CARS WRECKED BY A TORNADO AT TONAWANDA, N. Y.

THE WORK OF THE CYCLONE AT MERRITTON, CANADA.

As already stated, Merritton was the greatest sufferer by the cyclone. It is a manufacturing town, one and one-half miles from St. Catharine's, Canada, on the Welland Canal. There are two large paper mills and a cotton mill there. The two buildings of the Lincoln paper mill were destroyed. The roof was picked up, the walls were smashed in, and the heavy machinery went tumbling through the floor. Eighty employés were at work, and it was a miracle that only one person was killed. Over $150,000 damage was done to the two buildings of the paper mill. The ward schoolhouse, containing seventy-five pupils, was overthrown; one girl was killed and a score were badly injured. Twenty children were injured in another schoolhouse. "Orange Hall," the local home of the Orangemen, was razed to the ground.

Our engraving shows the terrible destruction of the cyclone. In front are the ruins of Orange Hall, the schoolhouse in which the child was killed is in the background to the left, and the chimney of the Lincoln paper mill is shown to the right. Another engraving shows the house of John Gardner, showing the enormous power possessed by the cyclone, which in a moment turned a substantial house into kindling wood, and also wrecked a brick house. The Presbyterian church was completely destroyed. The spire of the Episcopal church was torn down and the power house of the Acetylene Gas Company was also wrecked. In all twenty buildings at Merritton were destroyed, and it was thought the loss would be $225,000. The cloud took a zigzag course through the town near the paper mill, where there were several cars loaded with paper. They were tossed into the mill race and the air was filled with flying paper. Some bits were picked up five miles from Merritton. At Grantham the storm played several tricks. One house was blown down and a red hot stove picked up and carried across the road. A baker's wagon at Merritton was picked up and the boy driving was carried sixty feet and deposited in the street. St. Catharine's also suffered greatly. The cyclone lasted but five minutes at Merritton and its approach was watched by many of the townspeople. Outside of the tornado belt the sun was shining brightly. A cyclone of this nature has never been known in this region before. The cloud, its appearance and its method of working, as well as the devastation which it wrought, are all identical with the cyclone of the West.

The Telephone Kite.

According to the journal Electricity some recent experiments have been made in England, in which a kite was made to support a telephone wire. Apparently the middle of the wire was fastened near the kite, which was flown from a ship, as if at sea. One end of the telephone wire remained on the ship, the other was dragged by the kite a long distance to leeward until it was without difficulty dropped on the deck of H. M. S. "Dauntless," where it was secured and attached to a telephone apparatus. In this way vessels that are perhaps two miles apart can be brought into telephonic communication, and when no longer needed, the kite and telephone wire are reeled back to the first vessel without any loss. In the present case the experiment lasted four hours, during which time the kite remained suspended, held in place by the two wires and communication between the two vessels was uninterrupted.

It would seem that such a method of communicating between the shore and a vessel to windward wrecked in the breakers would sometimes be as useful as the Francis life-saving apparatus. The kite telephone, so called, would prove especially valuable at nighttime. The same method would seem to be as practicable for carrying a telephone wire over a difficult country or forest as over the ocean, and probably as useful in war times as in time of peace.

Rats in the Azores.

A resident of Fayal, says the Revue Scientifique, complains of the abundance of rats and rabbits. The rats multiply fast, and make all sorts of depredations, not only within houses, but in the fields and gardens. They attack a great number of edible fruits, such as bananas, oranges, and grapes; they infest granaries, houses, and fields. Among other depredations, the rabbits have attacked a field of tea plants, and of 4,000 vigorous shoots that were set out by the proprietor, they have destroyed 3,988 completely, leaving him 12 by way of consolation. The farmers are beginning to ask what they shall do. Shall they import the mongoose? The example of Jamaica makes them hesitate. And still another example in the Azores is of a kind to render them cautious in matters of acclimatation. The pigs there have been allowed to run wild and live in a state of freedom; the result is that imported partridges have almost entirely disappeared, the young having been eaten by the swine. It is thus difficult to tell what to do, and meanwhile rats and rabbits are abandoning themselves to all sorts of excesses.

HOUSE COMPLETELY WRECKED BY A CYCLONE AT MERRITTON, CANADA.

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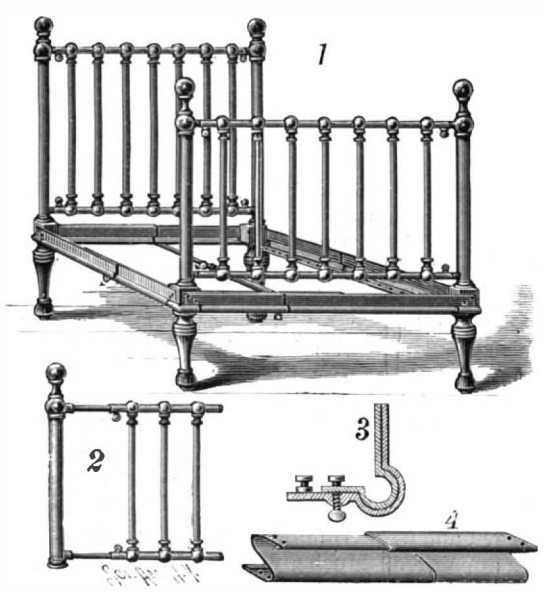
Cross Lighting.

Some traditions die hard, being accepted without examination by nine persons out of ten and by all who are in or under authority and, like officials generally, opposed to, or suspicious of, innovation. Among these is the belief in the hurtfulness of cross lighting. This method of lighting would seem only to be held injurious in schools, for in our own houses we are only too pleased if we can have windows on two or more sides of a room. Even in Germany, where statistics and experimental investigation pervade every department of administration, and where in each detail the executive is guided by an order in council somewhat inappropriately called an "Erlass," we find cross or double lighting still expressly condemned. Yet Cohn and Förster, Javal and Ferrand, Rumbold and a Royal Commission on School Construction have urged the groundless nature of the prejudice. Provided always that the eyes are not dazzled and that no shadow falls on the reading or writing, it is impossible to have too much diffused daylight or its artificial equivalent. The loss of intensity with increasing obliquity of the rays of light is acutely felt in wide rooms, especially when not high in proportion, on the side opposite the windows; whereas if there be windows or lights on each side, the intensity of illumination is equalized and its total amount doubled. It is only necessary that that coming from the right should be naturally or artificially the weaker, as by having the windows north and south or by filling those on the right with clouded glass. Windows in front are always objectionable, but light from behind, if not so strong as to cast a shadow, can but serve to increase the illumination derived from the proper quarter. As Cohn and Förster long since pointed out, reading or other work demanding clear but effortless vision is in the open air when the sky is overcast a real luxury. Under these circumstances the light is ample but shadowless; it comes from everywhere, but from no one quarter more than from another. The most perfect artificial illumination conceivable is that obtained by Hrabowski's arrangement of hemispherical milk glass reflectors with prisms and mirrors by which the light of an electric arc lamp is diffused equally throughout the building, though the source is hidden from view. The light is photometrically equal to that of a clear summer day and as free from color; it is almost shadowless and is, in fact, superior to daylight in not being liable to fluctuations, although its intensity can be regulated at will.—London Lancet.

A NEW EXTENSION BED.

An extension bed has been patented by Alfred W. Furnival and Henry Martin, of Second Avenue, Astoria, N. Y., which may be adjusted in length and width to meet various requirements. With this object in view, the side and end rails are made in two parts adapted to slide one upon the other. As indicated in the cross section in Fig. 3, these rails are constructed of plates so bent as to form vertical and horizontal flanges which are united by a bulb. The rail sections may slide longitudinally, but are prevented from being laterally displaced by the peculiar construction of the bulb. By means of a screw, the two parts of each rail may be held in any desired position. To the rails corner-blocks are secured and provided with legs. Corner-posts are carried by the blocks and have adjustable connection with the head and foot pieces. As shown in Fig. 2, the head and foot pieces are composed of horizontal tubes and vertical connecting rods. The horizontal tubes slide over rods fixed to the corner posts and are held in any desired position by means of screws. The springs for this bed are shown in perspective in Fig. 4. These consist of reversely curved plates adjustable longitudinally and rolled over or beaded to prevent lateral displacement. The springs are held within the bed by means of holes engaging pins on the side rails, and are supported at their central portions by means of a rod made of telescoping sections and extending between the end rails.

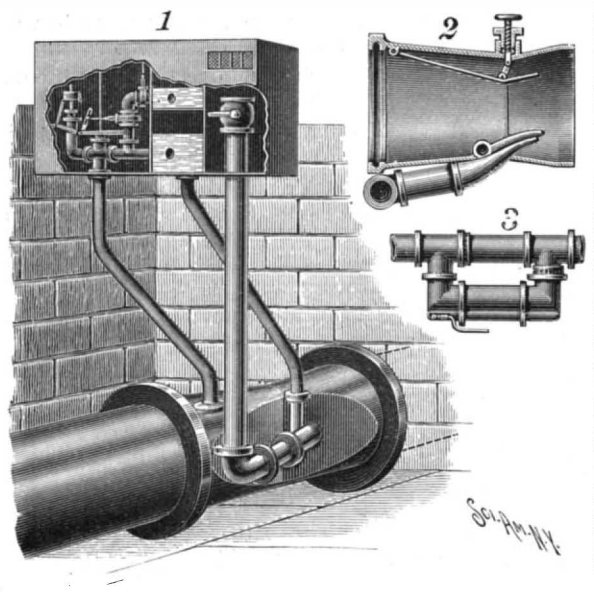


A NEW EXTENSION BED.

Among the many advantages claimed for this bed are its structural firmness and its ready adjustability to conform with the accommodations afforded by various rooms. The construction of the springs is noteworthy for the novel means employed to prevent sagging of the central portions.

AN APPARATUS FOR PURIFYING WATER.

The methods usually employed in purifying water require costly pumping and filtering stations and special machinery. It is the purpose of an invention patented by the designing engineer of the Brooklyn Water Works, Mr. Samuel McElroy, 170 Broadway, New York, to supersede these expensive appliances by providing an apparatus in which the force of gravity becomes the agent of applying air or antiseptic solutions to the water running in a conduit.



McELROY'S APPARATUS FOR PURIFYING WATER.

In the line of the conduit the inventor places the induction valve shown in Fig. 2, the casing of which is contracted between its ends, so as to produce an increased velocity of water in the throat thus formed. This valve is further provided with inlets for the entrance of air and of antiseptic gases or solutions, and with a deflecting plate adjusted by a screw rod to promote the increased velocity of the water. A casing, as shown in Fig. 1, is placed near the induction valve and is provided with an air chamber properly connected with an inlet to the induction valve and with a check or stop valve to guard against reactions. The casing is furthermore provided with a solution chamber and with a mixing chamber also connected with the induction valve and guarded by proper check and stop valves. The solution and mixing chambers supply the antiseptic gases as they are required. A roil pipe is applied to the conduit as shown in Fig. 3, for the purpose of collecting the organic matter with which the water may be impregnated.

In operation the water flowing through the conduit will produce a draft which draws through their respective pipes the air from the air chamber in the casing and the antiseptic solutions stored in the solution chamber. The impurities of the water coming into contact with these corrective agents will be destroyed or neutralized.

Among the advantages claimed for this apparatus are its automatic action and its cheapness.

The Slime on Fishes.

A fish just taken from the water, if handled, says The New York Sun, is found to be slippery and coated with slime. All fishes, the meanest and the noblest, killi-fish and shark, shad, salmon, and trout, wear this slime. They could not exist without it.

The slime is secreted usually in a continuous series of ducts with numerous openings, arranged in a line extending along the side of the fish. Some fishes have one line on a side, some have five or six. The lines may be plainly visible, and in some cases appear to be a marking on the fish. More often they are not observable at all. Some fishes store this secretion in pores distributed over the whole surface of the body, the larger number, however, in pores in lateral lines. There are also pores for the secretion of mucus or slime in a fish's head.

The slime is exuded through the divisions between the scales to the outer part of the body, over which it spreads, forming a sort of outer skin or covering, transparent, and having elasticity and tenacity, and often considerable body. It would not be remarkable for a fair sized fish, say a fish of two pounds weight, to have a coating of slime a thirty-second of an inch in thickness. Fishes vary greatly in the amount of slime which they secrete; the eel will suggest itself as one that is very slimy.

The fish's slimy coating reduces its friction when in motion and helps to increase its speed. It aids in protecting the scales from injury, being of sufficient substance to serve in some measure as a cushion. The slimy covering makes the fish hard to hold, and so enables it the more readily to escape from its enemies. It is sometimes repugnant to other fishes, which are repelled by its odor. It is the slime from the fishes handled that makes the angler "smell fishy" as the expression goes.

A most important function of the fish's slimy coating is to protect it from the attacks of fungus, a form of plant life found in all waters, salt and fresh, including the purest. The slime covers the entire exterior surface of the fish, including the fins. Fungus does not attach to the slime; but if the fish were to be injured so that there was upon it some spot uncovered by the slime, upon that spot some minute fragment of fungus, so small as to be scarcely more than visible, would be likely to lodge. Once lodged, the fungus is reproduced very fast.

Fish sometimes recover from attacks of fungus, but much more often they do not. The fungus displaces the skin, inflammation is set up, and the place attacked becomes practically a sore. With its continued growth the fungus may cover the side of the fish and extend over the gills and finally kill it.

THE "SENTINEL" BICYCLE-LOCK.

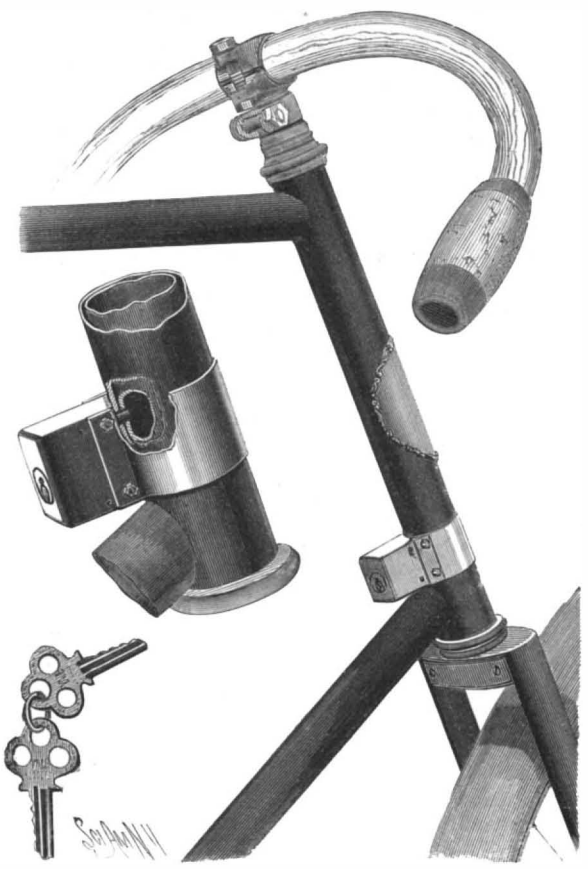
An ingenious bicycle-lock, which will no doubt find very general favor with wheelmen, is now being introduced by the Yale & Towne Manufacturing Company, of No. 9 Murray Street, New York.

The lock, as shown in the illustration, is intended to be permanently fastened to the steering-head of a bicycle, and is designed to hold the front wheel at an angle to the frame, thus rendering it impossible for the bicycle either to be led or ridden away.

The locking mechanism is that of the well known Yale pin-tumbler type, which makes the number of key changes practically limitless, thus absolutely precluding the possibility of other keys being in existence which may fit the lock.

We learn from the manufacturers that, during the past summer, a number of these locks have been in use by riders, and that it is their unanimous testimony that they are of the greatest service.

The lock is of neat design and finish, and, to quote one rider, "no better insurance can be put on a wheel."



THE "SENTINEL" BICYCLE-LOCK.

It is thought that it will be extensively placed on bicycles by manufacturers, as a special feature for the coming season; but it may be easily applied to any wheel. While shown in the present cut attached to the head with a separate band, it may also be used directly behind the name plate; the latter being employed as a band to secure it to the wheel.

We hear that one of the largest bicycle manufacturers in the country, having an extensive export trade, has undertaken to introduce the lock throughout Europe.

A VELOCITY of 8·3 or 10·6 kilometers per second is obtained for the wave front of the Indian earthquake of June 12, 1897, the two values being obtained by means of the two times recorded for the start of the earthquake at Calcutta. The velocity of the propagation of the maximum inclination of the earth's surface to the vertical comes out 2·61 or 2·76 kilometers per second. —G. Agamennone, in Science Abstracts.

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Science Notes.

An alcohol thermometer 70 feet in length is now being put in place at Winchester, Mass. It will be placed in a pit of its own depth and be used for scientific measurements of the earth's temperature. It is constructed on the same principles as smaller instruments.

The great telescope for the Paris Exhibition of 1900 is said to be making good progress, and it is expected that a magnifying power of 10,000 will be used on occasions, but 6,000 will be the normal. The aperture will be 1¼ meters, or nearly 49¼ inches, the focal length being nearly 197 feet.

The French Société d'Encouragement has awarded the grand prize of 12,000 francs to M. Moissan for his numerous researches in chemistry; the prize of 2,000 francs for the experimental study of the properties of metals and alloys to M. C. E. Guillaume; and an encouragement of 500 francs to M. Capredon for his work on metallurgical chemistry.

The hypothesis is put forward by H. V. Gill, in The American Journal of Science, that the stratification of the electric discharge in Geissler tubes is due to gas-waves somewhat analogous to those which produce the dust figures in a Kundt's tube. This theory is supported by dust figures obtained by electric discharges at various pressures of gas.

The employment of individual glass jars for the retention of milk delivered by peddlers has been prohibited by milk inspectors in several cities, on the ground that they are dangerous to public health. The objection is advanced that their sterilization is impossible, as water of the requisite temperature to destroy germs would break the jars. Safety is only insured by the use of receptacles that can be subjected to steam heat. The glass jar has been tabooed at the West Point Military Academy, and should be generally abolished, and especially its pasteboard overlid.—Phil. Med. Jour., August 13.

A chronograph has, says the Deutsche Uhrmacher Zeitung, been invented which is said to excel by far all former achievements in this field, and to admit of measuring one millionth part of a second and even smaller spaces of time. The apparatus is based on the following principle: At the end of a tuning fork of a very high number of vibrations a hole is provided, through which a pencil of rays falls upon the case of a revolving cylinder whose circumferential velocity is thirty meters per second. In consequence of the quick vibration of the tuning fork and the rotation of the cylinder, the said luminous tuft describes upon the cylinder, which is doubtless covered with paper sensitive to light, a curve whose dimensions correspond to certain particles of time.

In one of the streets in the neighborhood of the famous London Bridge there has for some time been carried on an industry peculiar even to that city of curious and crowded occupations, namely, an eelskin leather factory. Here are prepared and manufactured an interesting variety of articles from the skin of the common eel. By means of numerous complicated processes the skins in question are manipulated until they resemble and would be easily taken for leather, although of a more glutinous and pliable nature. In one specialty this strange substance is cut into long, thin strips and plaited very closely together for whiplashes and to cover portions of the handles of more expensive whips. Certain kinds of lashes and harness laces are also made from such skins, combining flexibility and toughness.

The following fluids are recommended by Amann for preserving biological specimens: Lactophenol: Carbolic acid, 20; lactic acid, 20; glycerin, 40; distilled water, 20 parts. Recommended for fronds of mosses, hepaticæ, fungi, and algæ. Lactophenol copper solution: Crystallized copper chloride, 0·2 part; crystallized acetate of copper, 0·2 part; distilled water, 95·0 parts; lactophenol, 5·0 parts. For preserving chlorophyl, recommended for Demidiaceæ, Palmadaceæ, Confervæ, etc. Concentrated lactophenol copper solution: Crystallized copper chloride, 2·0 parts; crystallized copper acetate, 2·0 parts; lactophenol, 95·0 parts; water containing algæ is mixed with 10 per cent of the above solution. The whole material is preserved thereby for a long time. Lactophenol glycerin jelly: White gelatin, 85; distilled water, 44; glycerin, 30; dissolve by heating on the water-bath, filter and mix with 10 parts of lactophenol. Lactophenol copper glycerin jelly: Prepared as above, with the substitution of 10 parts of lactophenol copper for lactophenol. Phyocyanin and chlorophyl retain their color excellently in this medium. Lactophenol gum: A strong solution of gum arabic in water 1, glucose 2, and lactophenol. For preparing mosses for the herbarium. Potassium mercuric iodide glycerin: The author states that the salt dissolved in concentrated anhydrous glycerin gives a mounting medium of 1·78 to 1·80 refraction index. He recommends the mixture for Diatomaceæ. The preparations are ringed on with amber or dammar varnish mixed with 2 per cent of boiled linseed oil.—**Pharm. Centr., xxxviii., 544.**

Miscellaneous Notes and Receipts.

Remedy for Bee Stings.—It is reported from France that the juice freshly expressed from poppy stems, if promptly applied on bees' stings, will immediately alleviate the pain and not allow an inflammation to occur.

Simple fire-extinguishers can be produced by anybody at a slight cost, says Technische Berichte. Dissolve 20 pounds of common salt and 10 pounds of sal-ammoniac in 30 liters of water and fill the mixture in quart bottles of thin glass. The extinguishers thus prepared are highly suitable to smother small fires. The bottles, which should be securely corked up and sealed, to prevent the contents from evaporating, are thrown into the flames of the starting fire or its immediate vicinity with enough vehemence to cause them to break.

A Balloon Trip Over the Swiss Alps.—The bold project long cherished by the well known aeronaut Spelterini to cross the Swiss Alps in a balloon is soon to be carried into effect. The Paris firm of Bésançon has constructed for Capt. Spelterini a balloon whose size surpasses that of all former ones. Its circumference is no less than 58 meters and the surface 1,065 square meters, while the contents is 8,768 cubic meters. The network surrounding the balloon is capable of sustaining 110,000 kilos, while the car lifts 76,000 kilos. The air ship weighs 1,000 kilos. The total rising power of the balloon, which is filled with hydrogen gas, is 3,700 meters; 2,000 kilos of ballast is taken along in sand bags. The weight of the passengers and their instruments is estimated at 400 kilos. The best silk stuff was used as material, 6,386 single pieces of silk being employed, whose seams have a total length of 4,440 meters. Everything is made as air tight as possible by repeated varnishing.

The expedition, which will be joined by the well known Swiss geologist, Prof. Heim, of Zurich, and a representative of the meteorological central station at Zurich, is a scientific one. The greatest attention has been paid to procure the best instruments required for the various scientific observations, so that reliable results may be looked forward to with certainty. The giant balloon, which bears the name of "Wega," has been exhibited from September 4 to September 13, at Zurich, whence it was taken to Sitten, in the Rhone Valley, from which place the ascent is to take place. There the last preparations are made for the project, which is as interesting as it is audacious, and the favorable moment for the ascent is awaited. This will take place as soon as favorable weather reports are received from the meteorological central station at Zurich and small trial balloons have demonstrated the presence of the suitable wind direction.—Staats Zeitung.

What is the Best Time to Take Medicine?—According to the Leipziger Drogisten Zeitung, Dr. E. Vogt gives in the Revue de Thérapie the following elucidations on the most suitable time for taking medicine. Most medicine can be taken any time on an empty stomach, before or after meals. But if an irritating substance is introduced into the stomach, it is important that it be not in too small a volume. If such a body is soluble in water, a highly diluted solution is given; if it is insoluble, it is given with the meal. The form of the drugs is also of importance. Thus hard pills, taken on an empty stomach, may irritate; likewise wafer capsules, whose contents first spread over a limited space in the stomach. But if such capsules, e. g., sodium salicylate, are given with the meal, the contents mix at once with the food and cannot cause any local irritation of the mucous membrane of the stomach. If, however, a prompt action is desired, the medicament is given on an empty stomach, but always diluted, because it is very sensitive to strong solutions. Many have an impeding or retarding action on the digestion, e. g., chloroform, naphthol, saccharin, etc.; therefore it is of importance to administer them when the process of digestion is past or almost so. In this category fall the metal salts, the iodides and bromides, which should be taken with plenty of water on an empty stomach early in the morning or late at night. Mercury salts irritate the mucous membrane of the stomach; therefore they are given in a diluted solution on an empty stomach early in the morning. The author cannot believe that calomel with cooking salt might partly become transposed into sublimate; at any rate, no accidents need to be apprehended from this source. Otherwise strict observation should guard against mistakes. A glass of quinine wine given before the meal causes a slight alcoholic stimulation in the stomach of a child, and one should be careful not to take this for the strengthening effect of the quinine. Therefore, it is better to give such wines after meals. Bitters should be taken the moment one sits down at table, not half an hour before the meal. It is imprudent to administer cod liver oil before the meal. Why coat the stomach with oil whose walls are expected to exercise an assimilating action? For that reason cod liver oil is given after eating or at least an hour before. Sodium bicarbonate taken before the meal causes too large a secretion of gastric juice. After eating it blunts the excess of acid.

Nickel and Aluminum Coins.

The Secretary of the Treasury will soon order the Philadelphia mint to resume experiments in the use of alloys in the five cent and one cent pieces, says The Washington Star. This will be done under a House resolution. The test will be to determine whether it is advisable to substitute pure nickel in these coins in place of the alloys now used. The Swiss and Italian governments use pure nickel in their minor coins, and they have proved satisfactory. Pure nickel is much harder than the alloy now used, and, it is said, would not abrade so quickly. Whether it would retain the color better must be determined, but those competent to judge are of the opinion that coins of pure nickel, after being in circulation for a short period, could not be distinguished from the present five cent piece. It is also thought the nickel coins would be more difficult to counterfeit, one reason being that they are highly magnetic, and another that the cost to the counterfeiter would be much greater than now.

The present alloy of the five cent piece is 25 per cent nickel and 75 per cent copper. Under the new process there would be about 94 per cent nickel in the coin. The two cent pieces have 95 per cent copper and 5 per cent of tin and zinc.

Experiments are also to be made with aluminum. Heretofore these experiments have failed to produce results. The last experiments were made early this year. Prior to that the last experiments were in 1864.

In 1863 the director of the mint called the attention of the Treasury Department to the propriety of substituting coins manufactured of aluminum of the denomination of five and ten cents, to take the place of the fractional notes of these denominations in circulation at that time. In 1864 a number of experiments were made with an aluminum alloy containing 99 per cent of silver and one of aluminum, with a view to ascertaining the fitness of the same for coins of the denomination of five and ten cents. The alloy, however, did not work satisfactorily, as it was found that it not only discolored rapidly, but was difficult to work.

An alloy of thirteen parts copper and one of aluminum was also tried, as well as another of nineteen parts copper and one of aluminum.

These two alloys gave the coins a gold color, and the metal was found to be very hard, and it was difficult to procure perfect impressions.

At the request of the National Academy of Science and by direction of the Secretary of the Treasury, a number of other experiments were made in 1864 with aluminum, under the auspices of Dr. John Torrey, Prof. Bache, Prof. Henry, Dr. Barnard, and Prof. Gibbs, members of the academy. For this purpose a bar of alloyed aluminum was furnished, which upon assay was found to contain nine parts of copper and one of aluminum. These experiments were made with a view of ascertaining the adaptability of aluminum alloys for coinage purposes, also to test the tenacity of the same as compared with copper. The composition was found to be very rigid under the rolls, requiring many annealings, and proved very refractory in working, so much so that perfect impressions of the coins were not obtained.

No further experiments were made after this date with aluminum alloy for coinage purposes until the experimental pieces called for by the resolution were struck.

The Austrian government makes its minor coins of 97·37 per cent nickel, 1·30 cobalt, 0·32 copper, 0·80 iron, 0·14 silicium, and 0·07 carbon. Too much cobalt darkens the color, and an excess of iron and carbon makes the metal too brittle.

Improvements in Santiago.

Capt. Brady, of the United States Signal Corps, has been ordered to begin the construction of an overland telephone line 320 miles in length, from Guantanamo to Santiago and Manzanillo. The present cost of transmitting messages by telegraph from Guantanamo to Santiago is twenty cents a word up to thirty words and twelve cents for each additional word. Educational statistics have been prepared by Gen. Wood, and they show that forty-one per cent of the white population and twelve per cent of the colored people are able to read and write. The schools were to be opened the first week in October and attendance was to be made compulsory. English will be taught, and thirty teachers, at a salary of $60 a month, have been engaged and a superintendent, at $125 a month, has also been appointed. Much gratification has been expressed over the law-abiding nature of the people in the province, as there has been no murder since the occupation of the Americans, and the few crimes which have been committed are all of a petty nature. The city of Santiago is being put in an excellent sanitary condition.

AN observatory on Pike's Peak is to be built by the Manitou and Pike's Peak Cog Railway Company, and the contract has been signed for the construction of the tower. It is proposed to mount in this tower four powerful telescopes for the benefit of visitors.

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Correspondence.

The Largest Floating Dock.

To the Editor of the SCIENTIFIC AMERICAN:

In the issue of your valuable paper of September 24, you publish an article under the heading "The Largest Floating Dock in the World," accompanied by an illustration of the new pontoon dock of the Vulcan Company, of Stettin, Germany, the dock you have reference to.

Permit me to say that this is not correct, as there is a still larger floating dock in existence, namely, the one built by Messrs. Blohm & Voss, Hamburg, Germany, which has been in use at their yard for over a year and a half.

In comparing the capacities of these two docks, you will at once notice the considerable difference in favor of the Blohm & Voss dock, the dimensions of which are as follows:

Length	560 feet.
Breadth	88 "
Depth over sill	30 "
Draught of water	47 "
Freeboard	4 "
Lifting power	17,500 tons.
Time for lifting maximum load	1 hour.

Such steamers as the "Pennsylvania" and "Pretoria" have been lifted by this dock.

New York, September 28, 1898. C. P. O'SWALD.

Collectors for Wimshurst Machines.

To the Editor of the SCIENTIFIC AMERICAN:

Much as has been written concerning the Wimshurst machine and its several parts, the subject of collectors seems to be neglected.

For machines with sectors, the ordinary U-shaped collecting combs with numerous points seem to serve as well as any other form, but with sectorless machines there is a wider field open to research.

Some nine months ago two Wimshurst machines were built for experimental work, which have been in use almost ever since, one being made by myself and the other by Homer Bretz, an amateur electrician, of this city. My machine had two varnished plates of window glass 14 inches in diameter and ⅛ inch apart. The other machine had two similar plates, being different only in size, as they were 13½ inches across and $\frac{3}{16}$ of an inch apart. Both are of the uninclosed type, and were designed especially for experiments with the brushes and collectors. The 14-inch machine had sectors and the common U form of collectors. The Leyden jars were small in comparison with the size of the plates, being designed to give short sparks quickly following one another. The other machine was sectorless and had larger condensers, the sparks being larger and at greater intervals of time.

The sectors were removed from the 14-inch machine soon after completion, and the output of current was slightly increased in consequence. The collectors were next removed and a single point for each pole was presented to the face of the front plate, with a result that the output was still further increased, a 4-inch spark being readily obtained.

On the smaller machine the collectors were also removed and a thin steel wire, about 1½ inches long, was inserted between the plates at the place where the combs had been, and each wire was connected to the discharge rod at its own side of the machine. The result was past all expectations. A 6-inch spark was readily obtained, and they followed each other across the air between the discharging rods fully as fast as the 4-inch spark had formerly done.

My machine was again changed to the interplate collector, with equally satisfactory results. On account of the design of the machine, 4½ inches is about the limit of the length of the spark, but with the present collector the rate of discharge is greatly increased.

A sectored machine was tried with the interplate collector, with but little change in the length of the spark, as compared with that obtained from combs.

Later a Wimshurst machine with vulcanite plates was stripped of its sectors and provided with collecting rods placed between its plates, but it failed to excite. The strongest argument in favor of the interplate collector, aside from its high efficiency, is its extreme simplicity.

In a number of experiments on different machines, under widely varying conditions of weather, this form of collector proved its superiority over the comb collector. DAN MCNAUGHTON.

Charlotte, Mich., September 23, 1898.

AT the recent meeting of the Association Française pour l'Avancement des Sciences, M. P. Villard presented a communication upon the regenerative action of light on fluorescent screens of platinocyanide of barium. It is well known that when these screens are exposed for a long time to the action of X rays, the salt darkens in color and the fluorescence of the screen diminishes. According to M. Villard, an exposure of the screen to direct sunlight for fifteen or twenty minutes completely restores its properties. The infra-red rays in sunlight seem to be the most active in the work of regeneration. A practical suggestion is that such screens should be kept exposed to daylight, their properties being thus indefinitely preserved.

The Gondola: Its History and Manufacture.

In Mr. Horatio F. Brown's "Life on the Lagoons" there is an interesting account of the history and manufacture of the gondola, from which we condense the following:

The earliest authentic document relating to Venice is a letter by the secretary of Theodoric, in which is noted the light boats which were used by the Venetians, and which were tied like horses at the doors of their houses. It is certain that the early boats were unlike the modern gondola, and this word does not occur until the twelfth century, and its derivation is still an open question. It is generally believed, however, that it is derived indirectly from the Latin and Greek names for the boat in which Charon ferried souls across the Styx. To this day the passenger across a Venetian ferry lays his "obol" on a gunwale of the gondola, much as Charon's ghostly fares were wont to do. The earliest pictures of the gondola, or rather its immediate predecessor, date from the fifteenth century only. The next two centuries, the sixteenth and seventeenth, were the great period of Venetian magnificence and pomp, and the gondolas shared in the movement. For this period we have abundant evidence in the pictures in the Academy and in the Ducal Palace. The paintings of Gentile Bellini and Carpaccio contain many excellent views of gondolas of the time, and from them we see that the period of sumptuous development of the gondola was about to begin. The boats were covered with fine stuffs, embroidered in patterns of bright colors, and were open on the sides, giving shelter at the top only. The adornment of the canopy was the point of departure for the excessive luxury which gave rise to sumptuary laws. At the close of the sixteenth century the form of the gondola underwent a great change and approximated its present construction. The massive steel "ferro," or prow, which is, perhaps, its most striking feature, was added at this time. Various reasons have been suggested to explain the adoption of the "ferro," but the matter has never been satisfactorily cleared up. It is said by some that the "ferro" was introduced as a measure, in order to allow a gondolier to judge whether he could pass under any particular bridge. If the "ferro" passed, he knew that the gondola with its canopy could also go under without striking. Others maintain that the "ferro" at the bow acted as a counterweight to the rower behind, but this theory is destroyed by the fact that the earliest "ferri" were attached to both bow and stern. It is probable that the "ferri" were added for adornment and nothing more. The "felze," or canopy, became richer and richer, which caused the sumptuary magistrates to issue many decrees against them. Finally the use of color was tabooed and only coarse black woolen stuff was allowed; all carving and gilding were forbidden, and all of the metal work had to be perfectly plain. The government experienced the greatest difficulty in enforcing these regulations, for the nobles had a mania for display. One result of these laws remains to this day in the somber black which universally characterizes the gondola. Foreign ambassadors were alone exempt from the stringent decrees against color and decoration, and they availed themselves of their privilege to a remarkable extent. In the eighteenth century the gondola underwent its final modification and assumed the form which it now possesses. The ferro at the stern disappeared, and that on the bow was broadened into the hatchet head of the modern gondola which we know so well. The vessel was lengthened to gain speed, and the "felze" received its door and glass windows. In short, the type of gondola was fixed by the year 1740.

The trade of making, cleaning, and repairing the gondolas is active in Venice, and it is very easy to visit their open sheds and yards on the border of the city. In front of the shed a long slope leads down to the water's edge. This is well plastered with mud so as not to injure the boats when they are drawn up or lowered into the canal. A pitch pot is usually burning in one corner, and the men move about swabbing on the pitch and drying the same by burning piles of loose straw beneath the boats. The first thing to be done in building a gondola is to choose the wood of which the boat is to be made. It must be well seasoned and free from knots. These points are more essential in the gondola than in the case of other boats, for the planks of which they are made are so thin that they are liable to warp and the knots to become loosened and start.

When the wood has been chosen, the builder begins to lay down the gondola; four posts determine the length and width. The operation of building begins by setting up the stern and bow posts, which are made of oak. The ribs, of walnut, cherry, or elm, are then laid down. They are flat at the bottom, for the gondola is a flat-bottom boat, and the rounded uppermost ends of the ribs are joined together by a binder of oak. At the points where the bow and stern decks are to begin, two bands of walnut, rising in the middle, run across the boat from one binder to the other and act as a counter support to the ribs, which may otherwise be pressed in by the strength of the binder. When this is finished, the hull of the gondola, as far as its strength and structure lies, is complete. It remains to add the walls of pine and the bottom, which is likewise of pine. The floor rests upon ribs and protects the bottom, which is too delicate to bear treading upon without danger of starting. The deck used to be made of walnut, but now pine is usually used. The deck is divided into four compartments on each side by thin strips of carved or beaded wood. A little door closes the deck in front and makes the boat a safe place for the storing of the gondolier's possessions. Two steps in the bow permit of an easy embarkation or landing. The rowlocks and the foot rests are added, and here the gondola builder ceases his labors. The rest of the fittings are bought elsewhere. So far the gondola will have cost about $60.

The iron finishings for the bow and the stern are then bargained for at some smith's shop and made separately. Every part of the beak of the bow has its own name. Unfortunately, hand labor is being superseded in Venice, as elsewhere, and the handsome wrought iron ferros have given place very largely to cast iron substitutes, which are heavy and brittle, but the profession of a gondolier is in most cases hereditary, so that an old ferro is possessed by almost every family. The price of the "ferri" for the bow and stern is about $20, which brings the cost of the boat up to $80.

The boat is now ready to navigate the canals, but in order to fit it to carry passengers, the "felze," or little house in which the passengers sit secure from wind and rain, must be added. The mountings of the "felze" are of brass, and the cost of the whole is not far from $100; so that it is seen that the boat is rapidly increasing in expense. The "tenda," or summer awning, is a modern device, and is quite popular with tourists, but the more conservative among the Venetian families are slow to adopt it. The carpet, cushions, and the arm rests must be added to the cost, which amounts to about $40, so that the entire cost of a new gondola is not far from $220. The young gondolier just starting in life is not likely to have such a sum by him; so the practice is to pay down a certain amount at once and to discharge the remainder in monthly or quarterly payments.

When the gondola is new, it is left unpainted on the outside for the first year, as an intimation of its use and also as a sort of guarantee to any possible purchaser, for the value of the gondola falls immediately after it is painted, for then it is impossible to ascertain the condition of the wood and the presence and absence of knots.

The gondoliers soon become devotedly attached to their boats, and they study their character and peculiarities; for it is a strange fact about this most extraordinary of boats that it has a character and temperament of its own, in spite of the fact that the boats are all built on the same model; and much of the gondolier's skill in rowing depends upon his knowledge of his boat. He spends hours every day in sponging, scrubbing, and drying his boat, and he soon knows every nail in its hull and every scratch upon its steel or brass. Mr. Brown tells of a gondolier who identified, swore to, and recovered a pair of sea horses, which formed a part of the ornamentation of his boat and which had been stolen from him, on the strength of certain almost invisible scratches, which had escaped the notice of the thief.

With so much uncovered metal in the fittings of the gondola, it is, of course, necessary to keep these metals in a high state of polish, which occupies all the spare time of the gondolier. It may truly be said that the gondolier is known by his boat, and those who have lived for a long time in Venice are sure to glance at the "ferro" before picking out a boat, as this tends very largely to show the ability of the boatmen. Once every three months in the winter, and once every twenty days in the summer, the gondola must be hauled on shore, scrubbed, dried, and plentifully anointed with grease. This operation makes a surprising difference in the speed of the boat. The process of cleaning occupies a whole day, so that the gondolier not only loses a day's fares but has also to pay about 80 cents, which is a considerable tax upon him, considering the extreme smallness of the fare which he is allowed by law to collect.

If the gondolier attends properly to his boat, it will last in excellent order for at least five years. At the end of that time he can sell the hull for $20, and then take the rest of the fittings for a new boat, while the old gondola finds its way to one of the least frequented ferries, where it will do duty for another five years. It gradually loses its graceful curves and form as the woodwork fails, until at length it becomes a "gobbo," with its bows no longer sweeping up in a proud curve, but buried in the water; then its day is over. It is fit for nothing but to be sold, broken up, and burned in the glass furnace of Murano, the crematory of most ancient gondolas.

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THE OMAHA EXPOSITION AND THE INDIAN CONGRESS.

The Exposition at Omaha is a rare creation and is an unqualified success from every point of view. If one were to be asked what was the most interesting and beautiful feature of the Exposition, he would undoubtedly reply, "The electrical display at night." The lighting of the Exposition is a great advance over that of the World's Fair, and it is a significant fact that France has sent over experts to view the systems of lighting which have been adopted on the Grand Court at Omaha. One of our engravings represents the fireworks display on the grand plaza. It is doubtful if a more artistic display could be devised than that shown in our engraving. It is only another proof of the great success which pyrotechnic art has attained in America. Our other engraving represents a group of five Indian chiefs.

Photograph by F. A. Rinehart.

FIREWORKS, GRAND PLAZA, TRANSMISSISSIPPI EXPOSITION.

The attractiveness of the Exposition has been enhanced by the addition of a new feature. This is the Indian Congress, which is organized with a view to assembling the representatives of every tribe of Indians on this continent, and that idea inspired the Indian Bureau at Washington to avail itself of this rare chance to present an ethnological exhibit never before attempted, and it is not likely that such a representative collection of Indians can ever be gathered again. Congress appropriated $40,000 for a great Indian encampment at the Transmissisippi Exposition. It was entirely a case of persuasion, for the Indians were not coerced into going to Omaha, but, having once reached that city, they seemed to understand what the Indian congress really meant, and are satisfied and happy. The agents were instructed to send old men, and, as far as possible, "head men," who would typically represent the old-time Indian, subdued, it is true, but otherwise uninfluenced by the government system of civilization. These instructions were faithfully followed, and as a result the Indian congress is composed of hundreds of the best types of the various tribes. All of the tribes that are of any interest from an aboriginal standpoint are represented at the congress. Some of them have become so civilized, like the Creeks, Choctaws, Cherokees, and Seminoles, that their presence would add little interest from an ethnological point of view; so the government did not assemble its most civilized proteges at Omaha, but the tribes it has conquered with the greatest amount of bloodshed are the most important at the congress.

When the congress was formally opened on August 4 thirty-five tribes were encamped on the grounds, aggregating about five hundred Indians. The northwest corner of the extensive Exposition grounds were given up exclusively to the big Indian camp. There they are living in primitive style, housed in tepees of tent cloth or birch bark or rush mat wickiups. In some cases the tepees are made of buffalo skins.

The object of the congress is to truly represent the different Indian tribes and their primitive modes of living; to reproduce their old dances and games; show their manner of dress; illustrate their superstitions, and to recall, as far as possible, their almost forgotten traditions. They also have an opportunity to prove their skill in embroidery, basket weaving, and, most important of all, the congress affords an opportunity of comparing the various Indian tribes, to study their characteristics and tribal traits. When told, before coming to the congress, that they would meet other

Four Bulls, Assiniboin. Antoine Moise, Flathead. Different Cloud, Assiniboin. "Kills the Spotted Horse," Assiniboin. Eneas Michel, Flathead.

REPRESENTATIVE INDIAN CHIEFS, INDIAN CONGRESS, OMAHA EXPOSITION.

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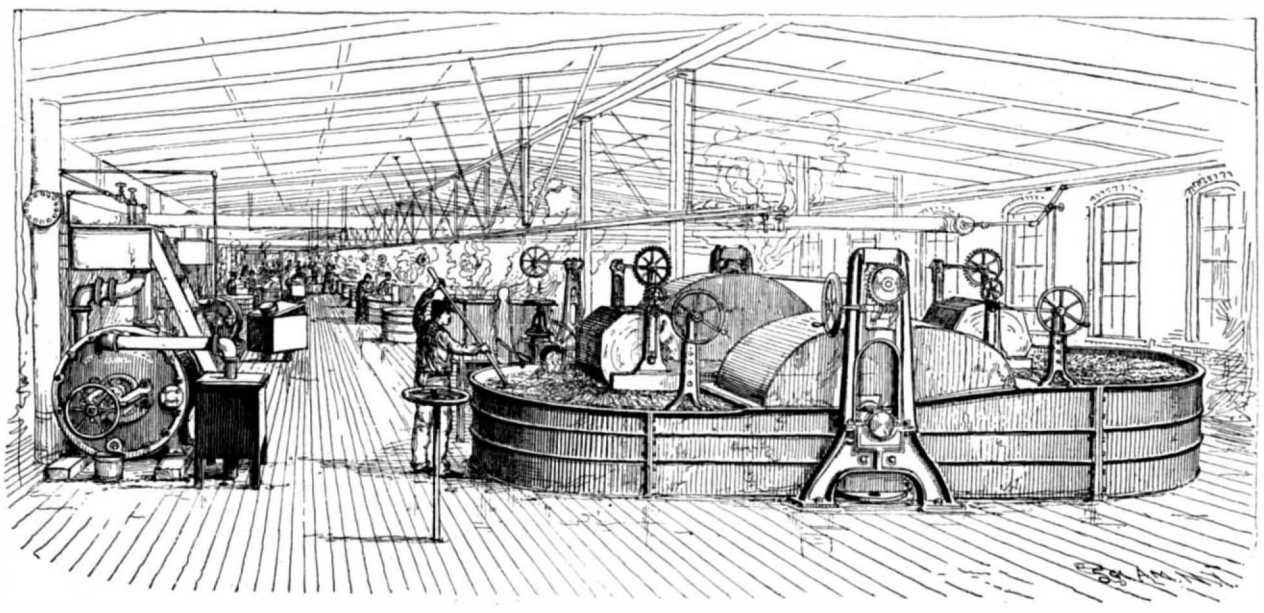
Indians, their chief fear was that it would be necessary to renew the old tribal feuds, but, once on the ground, this idea was soon dispelled, and it is now amusing to see with what formality the tribes exchange civilities. For instance, when the Sioux Indians pay a call to the Arapahoes, the visitors dress with great care and march singing to the Arapahoe village. The Arapahoes met them with a song of welcome, and a formal handshaking follows with an exchange of gifts, and peace is declared between the two tribes. Of course, in most cases the Indians are not able to communicate with each other except through the aid of an interpreter, as their languages are different.

Our engraving shows a group of representative Indians of two of the most interesting tribes, the "Flatheads" and the "Assiniboins." The Assiniboins are considered particularly good Indians, and cause little disturbance. They boast that they never fought white men, but with the Cheyennes, Crows, Black Feet, and Nanktons. "Different Cloud," "Kills the Spotted Horse," and "Four Bulls" are three famous chieftains of the Assiniboin tribe. All three were born at the Fort Peck Agency, Montana, and have lived there all their lives. "Different Cloud," also known by the name of James Garfield, is thirty-two years of age, and in the famous battle waged between Gen. Miles and Sitting Bull, on Milk River, he did good work for the government, his horse being shot under him. In the course of the fight he scalped six of the Sioux and captured twenty-five horses. "Four Bulls" is also known by the name of James Robert. His career has been a comparatively peaceful one, having only been in one fight against the Crows. He is twenty-nine years of age and speaks English. "Kills the Spotted Horse," whose English name is Allen Clancy, is thirty-three years of age. Five years ago he took part in a fight with the Creeks, and his horse was shot under him and he received two wounds which resulted in his being laid up for three months. When he got well he started out with a party of friends to seek revenge. They stole sixty-five horses from the Creeks and returned home to the agency with this booty. They were promptly arrested for fighting and placed in the guardhouse. The spirit of their forefathers evidently dwelt with them, for they agreed to die by each other's hands. By some means they procured a pair of scissors, with which they stabbed each other. When the jailer arrived, all were dead but "Kills the Spotted Horse," who afterward recovered in the hospital. He is about as striking a type of Indian as any at the Exposition. Antoine Moise and Eneas Michel are from the Flathead agency in Montana. Antoine Moise, though only a little over thirty years of age, has had a very eventful career. Eight years ago he was wounded in battle between the Flatheads and Crow Indians, and the Crow Indian who shot him is on the Indian encampment grounds at Omaha. The other event in his life was his trip to Washington in 1893 to see the "Great Father."

Eneas Michel is twenty-four years of age and has lived all his life on the agency. He speaks English very well and does not call for any special mention.

The scene, particularly at night, is intensely picturesque. Small cooking fires scattered around dimly light up the strange picture, throwing a red glow upon the decorated tepees, while across the trails prance the stalwart braves lavishly decked out with blankets. It is a curious and interesting fact that less than half a century ago the same docile Omaha Indians who peacefully doze by the camp fires within the Exposition gates were waging the war of the tomahawk and arrow on these very grounds, which is a gratifying proof of the triumphal march of civilization.



BEATING AND REFINING ENGINES.

THE MANUFACTURE OF PAPER.

III.—THE PAPER MILL.

In our issues of March 19 and April 30, of this year, we described at considerable length and with the aid of numerous illustrations the processes by which the spruce and poplar logs are manufactured into sulphite and soda fibers. It was shown how the logs are cut into "chips," the length of whose fiber is from one-half to three-quarters of an inch; treated with chemical solutions in huge "digesters," where the "cooking" serves to dissolve out the soluble, incrustating matter of the wood—resin, lignose, cellular matter—leaving only the pure fiber; then washed and screened, and finally bleached, leaving a pure, white, vegetable fiber ready for manufacture into paper in the paper mill proper.

Before describing the final processes, it will be well to mention that there are, broadly speaking, at least six different grades of paper recognized by the manufacturers.

1. The lowest and cheapest of these is *wrapping paper*, such as is used for large parcels and packages. This is made from the screenings and refuse from the different mills.

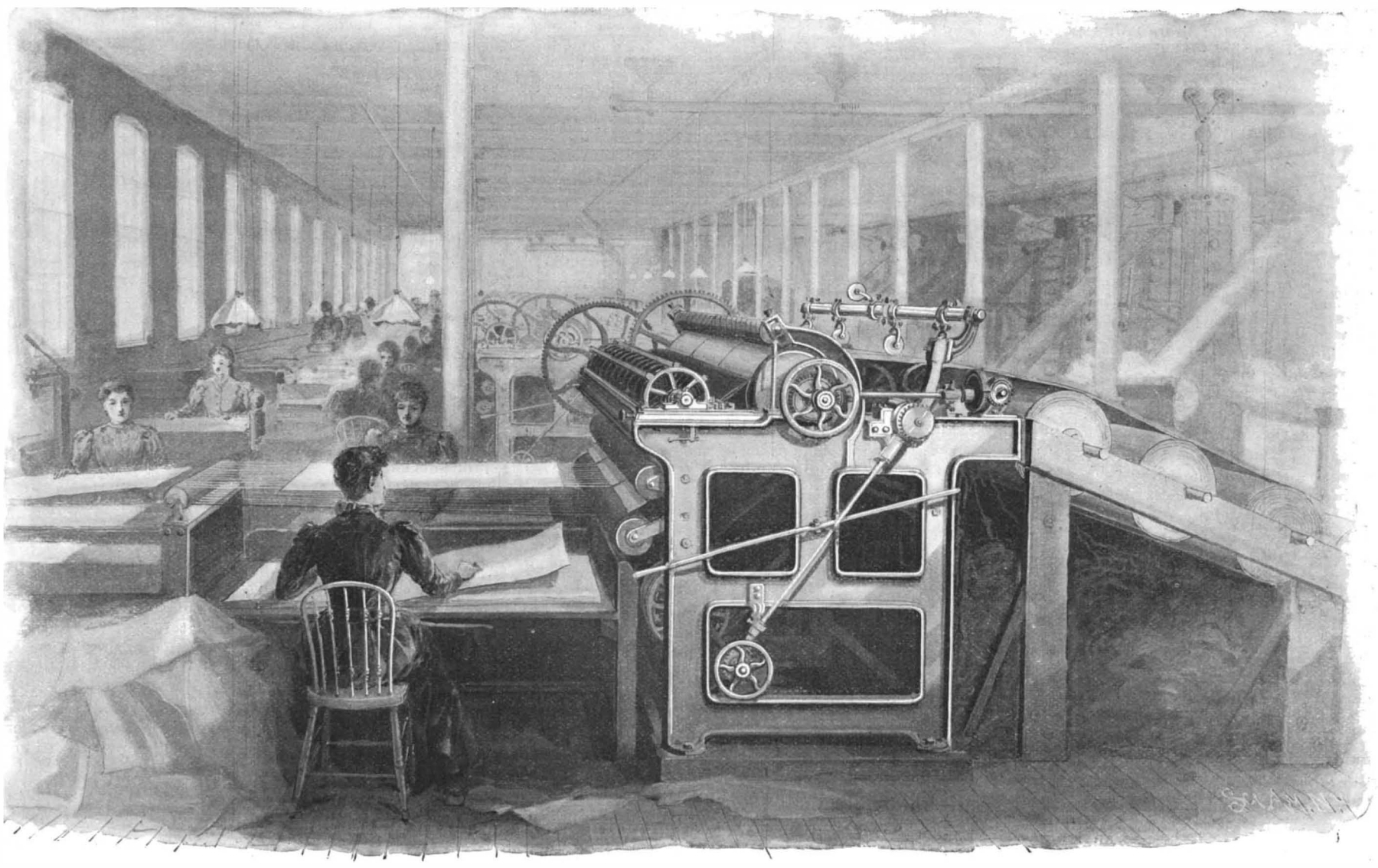
2. *Cheap or "bogus" manila*, made chiefly from ground wood and sulphite fiber, and used for cheap bags, such as are used in retail stores.

3. *Best grade manila*, made from jute and old rope, used for flour sacks and cartridge paper.

4. *News papers and hanging papers*, manufactured from ground wood and sulphite pulp. This grade is practically the same as No. 2, with the difference that the cheap manila is colored. The wood pulp not being chemically treated, the resinous and acid matter remains in the pulp, and in course of time discolors the paper. It is for this reason that old newspapers become discolored and fade to a yellowish tint.

5. *Book paper*, such as that upon which the SCIENTIFIC AMERICAN is printed, made from bleached sulphite and bleached soda fiber, mixed.

6. *Fine writing papers*, such as note, bond, bank note, tracing, and bank folio paper. This is made from a mixture of rag and wood fibers, and the finest



THE MANUFACTURE OF PAPER—MACHINE FOR CUTTING THE FINISHED PAPER TO SIZE.

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grades are manufactured from new cotton and old linen rags.

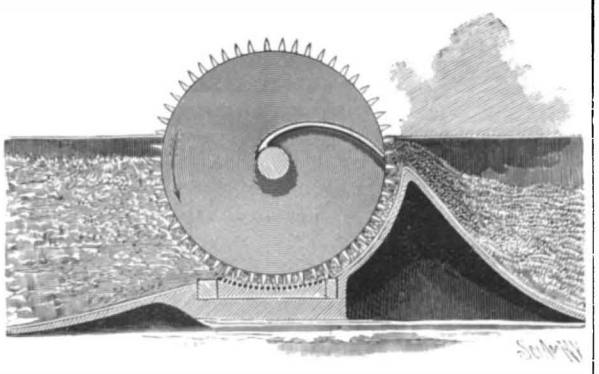
The first step in manufacturing the pulp into paper is to place it in what is known as the beating engine. This consists of a shallow, cast iron tank with semi-circular ends, on one side of which, with its axis at right angles to the longer axis of the tank, is a large revolving roll about four feet in diameter. The surface of the roll is filled with a series of "fly bars," or parallel strips of steel ⅜ inch in thickness and about 5 inches in depth, which extend the full width of the roll and are spaced about 2 inches apart around its periphery. The radius of the roll is slightly greater than the depth of the tank, the bottom of which is curved upward to the rear of the roll, leaving only a narrow passageway for the stream of liquid pulp to pass through. Immediately below the roll a bed-plate, covered with rubbing-strips of ¼-inch iron, is let into the floor of the tank. The roll is carried in adjustable journals, whereby the space between the face of the roll and the bed-plate may be regulated. The beating engine is 3½ feet deep by 24 feet long, and its capacity is over 1,500 pounds of finished paper. It is loaded with bleached sulphite and soda fiber, brought from the respective mills, and with the proper percentages of clay, starch, sizing, alum, and other materials. The rotation of the roll causes the mixture to flow slowly around the tank. The pulp is drawn in between the roll and the bed-plate, where the action of the iron bars serves to separate and draw out and beat the fiber. By raising or lowering the roll and increasing or reducing the space between the opposing bars on the roll and the bed-plate, the fiber is drawn out to the desired extent. The manipulation of this roll is one of the most important operations in the process of paper-making.

On the opposite side of the engine to the roll are two washers, eight-sided revolving cylinders of wire cloth, with interior scoops which run from the wire cloth face to the interior and serve to catch and drain off the water that passes in through the cloth. The object of the washers is to completely remove all chemicals and other soluble impurities that come over from the sulphite and soda mills. Water flows continuously into the tank on one side and is drawn off by the washers on the opposite side. The process of beating and washing is carried on for about one hour; then the various mixtures, as given above, are added and the engine is run for several hours longer until the process is complete.

The pulp is then allowed to fall down into tanks from which it is pumped to the Jordan refining engines, which are shown to the left of the beating engines in the illustration. This machine consists of a swiftly revolving cone upon the surface of which is a series of knife blades. The cone revolves within a conical drum and the pulp is introduced at the smaller end and driven by centrifugal action to the larger end, at which it is discharged. The purpose of these machines is to make the fiber of an even and suitable length, that which is to be made up into thin papers requiring to be longer than that for thick papers.

After the fiber has been treated in the fining engines, a certain amount of water is added to give it the proper consistency, and it is run through screens located at the head of the Fourdrinier paper machines, two of which are shown in the accompanying illustrations of the Duncan Paper Mills. The Fourdrinier machine, so named after the Frenchman to whom this beautiful invention is due, is one of the most ingenious and perfect devices to be found in the whole range of the industrial arts. The most interesting feature of the machine is the endless traveling wire cloth, herewith illustrated, on which the fiber is interlocked or woven as it were, the water drawn away, and the residue worked into sheet form. The pulp, duly beaten, refined, screened, and diluted with water (as explained above), is piped into the "flow box," a deep rectangular box extending across the full width of the machine), from which it flows out in a thin stream onto an endless 70-mesh wire cloth. The cloth is 118 inches wide and runs over end rollers placed 26 feet apart. To prevent the stream of pulp (which has the appearance and consistency of watered milk) from flowing laterally over the edges of the wire, two endless rubber guides or bands, 2 inches square in section, travel with the wire over the first 20 feet of its length. These guides, known as deckles, run over two pulleys above the wire. The upper half of the wire is supported by and runs over a series of rollers as shown in the illustration. As the pulp passes from the flow-box the particles of fiber float in it just as an innumerable multitude of particles of cotton fiber would float in a stream of water. To unite and interlace the fibers, the wire is given a lateral oscillating or shaking movement, which serves to interlock them much as the warp and woof are interlaced in a textile fabric. Meanwhile the water strains through the cloth, leaving a thin layer of moist interlaced fiber spread in a white sheet over the wire. The separation of the water is further assisted by troughs (suction boxes), which extend across close beneath the wire. Suction pumps connected to these boxes draw the water from the pulp as it passes over them.

The wire with its layer of moist pulp now passes below a roll (known as the "dandy roll") which compresses the fiber, and then below a second and larger roll known as the "conch roll," upon which is a felt jacket shrunk tightly on, which presses out more of the water. The fiber next passes to the "first press," where it is caught up on an endless felt and passed between two rollers, the upper one of wood, the lower of iron covered with rubber, where more water is pressed out of the sheet. Then it passes through the "second press," consisting of an upper roller of brass and a lower roller of iron covered with rubber, where more moisture is pressed out, and finally the sheet commences its long journey up and down over a series of 17 hollow



ROLL AND BED-PLATE OF THE BEATING ENGINE.

revolving iron cylinders, 4 feet in diameter, which are heated by steam. A "drier felt" passes over the rolls with the paper, for the purpose of holding it snugly against the hot surfaces. By the time it has passed over the 17 rolls the sheet is thoroughly dried out.

The surface of the dried sheet is at this stage of the process rough and entirely devoid of the gloss which is indispensable in all "book papers" with the exception of "antique," book paper being the particular grade the manufacture of which we are now describing. The desired finish is secured by passing the sheet through what are called "calender rolls"—a vertical stack of 9 highly polished iron rolls, which "iron" the paper as it passes through them and impart the proper degree of gloss or "finish." The sheet enters at the top and leaves at the bottom of the rolls, whence it is wound onto a wooden reel. There are two stacks of calender rolls to each paper machine.

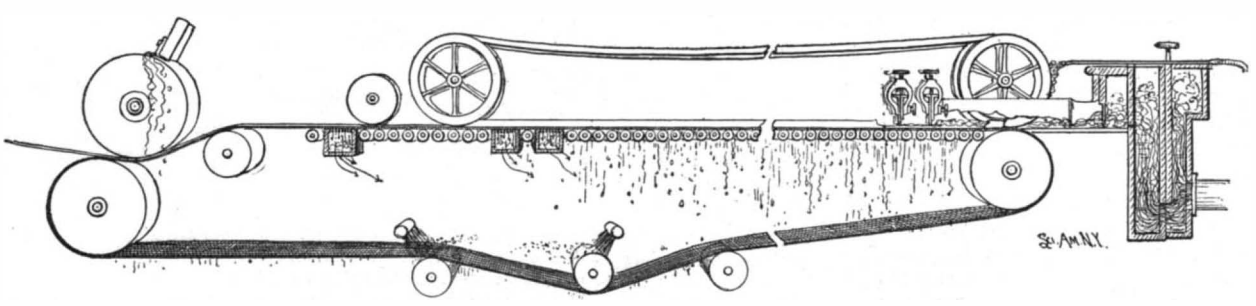
The whole process, from the time the liquid fiber is piped into the "flow box" at one end of the Fourdrinier machines until the dried and calendered sheet is wound onto a reel at the other, is completely automatic and continuous. The weight or thickness of the sheet is determined by the amount of flow of the fiber to the screens. The speed of the paper sheet, when the machine is running on "book paper," such as that on which the SCIENTIFIC AMERICAN is printed, is 140 feet per minute. When the machine is running on "news paper," such as that on which the daily papers are printed, the speed is as high as 500 feet per minute, or nearly 6 miles an hour.

If the paper is to be given a specially high finish, it is run onto wooden rollers and goes to the super-calenders, a series of 9 rolls in which the alternate members consist of chilled refined iron and paper, the paper and iron rolls being of different diameters. The rolls act upon the surface of the paper with a mangling effect, which imparts the desired finish. If a very high finish is desired, the sheet is passed a second or third time through the calenders.

The rolls of paper, which, as they come from the Fourdrinier machine, are from 92 to 112 inches wide, are then carried to the cutting machine (see illustration) and placed in a rack, from which they are drawn over a series of rollers and cut into sheets of the size required for the market. The disk cutters, which are seen arranged on a transverse bar above the first roll, cut the sheet into strips of the desired width, which are then cut to the proper length by a transverse knife.

The paper is then counted, weighed, and either boxed in wooden frames, baled in hydraulic presses, or rolled onto iron or wood cores ready for shipment.

There are few of the arts in which development has been more rapid or the changes more radical and sweeping than in the great industry which has formed the subject of the present series of articles. So true is this, that a first-class mill like that which we have now described, unless it holds itself at all times prepared to make costly changes to keep pace with the improvements of the art, would find itself falling hopelessly behind in less than a decade.



FOURDRINIER MACHINE—DIAGRAM OF THE ENDLESS WIRE CLOTH AND DECKLES ON WHICH THE FIBER IS RUN OUT INTO SHEET FORM.

Fluorescent Screens for Roentgen Ray Work.

A contributor to The British and Colonial Druggist says, from personal experience, that effective fluorescent screens may be made by the amateur, and that a material reduction in cost is thereby effected. Calcium tungstate he regards as a very fair material, and a salt of uranium he thinks very good (the particular salt not being mentioned). The method of making the screen is as follows: Take a plate of glass, say 8½×6½ inches; make a mask of stout paper with an opening 7×5; wet this mask with glycerine or mucilage of gum arabic and place it over the plate; cover the plate with collodion, or varnish, or mucilage (with a little glycerine added), and sift the powdered salt quickly and evenly all over the surface. If vellum, parchment, cardboard, or ebonite be used as the support, one may put a coating on both sides, and thus even up any inequalities of deposit; but with a glass support the same advantage will not accrue. Having got a good thick coating of powder, the mask is removed, but this does not matter very much; it has served its purpose to give a clear edge to the coating. The coated side, which must face the tube, if glass is used, is covered with a piece of thin black celluloid, or ebonite, or opaque paper. With vellum, parchment, or paper there should still be a black shield between the tube and the fluorescent salt, but the latter should be left uncovered and facing the eye. The platinocyanides may be used in the same way, though they do not powder nor sift so finely; or they may be mixed with varnish and spread over a glass or vellum surface; the trouble is to get a really even coating, but with anything but glass one can apply a roller pressure and thus smooth down any unevenness. The easiest way to get an even coating, according to the author, is to use a vehicle of paraffin and petrolatum. Equal parts of each are melted together, stirred until cool, and the powdered salt (about two drachms for a 7×5 screen) rubbed on a slab with just enough of the wax mixture to make a workable mass, which is spread by means of a long, straight spatula. An undesirable feature is the liability of the mixture to "run" in a heated atmosphere, but at normal temperature no trouble whatever is encountered. The author mentions that in addition to its value as a means of direct observation, the fluorescent screen reduces the time of exposure in making a skiagraph, being placed beneath the plate when exposed. In conclusion the author remarks: "Of course, it must be understood that even the best and most costly screen will not fluoresce to any extent if the rays are being delivered poorly and intermittently; it will not compensate for a poor and weak electrical discharge and faulty tube. As a gage by which to estimate exposures, I consider a good screen very valuable. With practice one becomes as intimate with the capabilities of his 'tubes' as a photographer with the capacity, as regards covering power and rapidity, of his lens."

Telegraphy Without Wires in Belgium.

Consul Gilbert sends from Liege, under date of July 19, a letter from a professor of a San Francisco school of engineering, who has been investigating inventions in wireless telegraphy. The professor refers to the system of Dr. Della Riccia, connected with the Montefiore Institute of Electricity, at Liege. Dr. Riccia has made improvements on apparatus already in use, simplifying it and increasing its power, and claims that he can confine the oscillations of the transmitter to any special point, to the exclusion of all others. In case of communication between war vessels or forts, the message could be transmitted to one alone; in case of fog at sea, the oscillations would not be limited. Dr. Riccia, it is said, can make the presence of a vessel known to another at a distance of 30 miles and telegraph real messages 7 miles. The full text of the report has been transmitted to the War Department.

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SPIRIT SLATE WRITING AND KINDRED PHENOMENA.—II.

BY W. E. ROBINSON.

A favorite trick of mediums at séances is to procure a message from the unseen on the blank piece of paper which has been placed between two slates. The medium holds the slates high above his head, and on taking the slates apart the paper is found covered with writing. This again calls for the use of an extra, or false flap, as shown in Fig. 1. (See our last issue.) A piece of paper with writing on it is placed downward on one of the slates and covered with the false flap. Of course, it now looks like an ordinary slate.

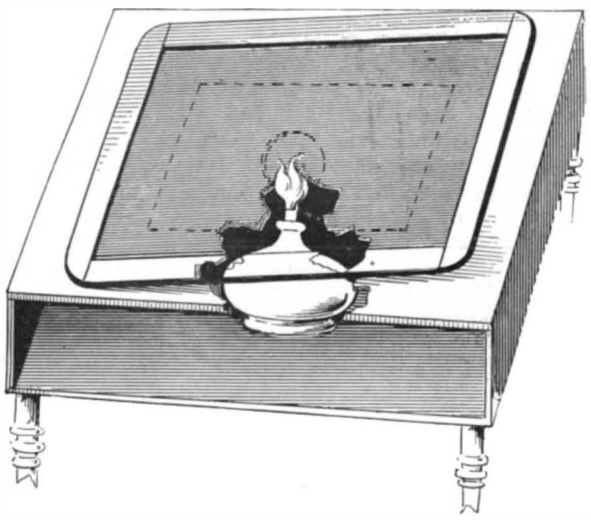


Fig. 4.—FALSE TABLE FOR DEVELOPING COMMUNICATIONS WRITTEN WITH SYMPATHETIC INK.

On this is placed the plain piece of paper, and over it is placed the second slate. The slates are now held up, and, on being lowered to the table, they are reversed, thus bringing the blank piece of paper under the false flap and the one with the writing on it on top of the flap which has fallen from the slate. On the removal of the top slate, the writing is found on what is supposed to be the original blank paper.

If the paper is to be privately marked by those who attend the seances, so as to make sure that the writing really appears on the piece of paper selected, another method must be employed, and the aid of the so-called "sympathetic ink" is invoked. Sympathetic inks are of various kinds, some appearing through the aid of a reagent and others through the agency of heat. The latter method is usually employed by mediums. The writing is done with dilute sulphuric acid, which is made weak enough so that the paper will not be destroyed. The heat required to develop the writing is obtained from a spirit lamp, which is concealed in the top of the table. The lamp is set directly under a trap in the table top. When the slates are placed on the table, they are laid over the trap, which is opened and the slates allowed to become well heated. The trap is then closed, and the prepared paper, upon coming in contact with the hot slate, is covered with writing.

Another method to produce spirit writing is to place a wide mouthed bottle over the trap. A piece of paper is put into the bottle, which is corked and sealed, and the writing makes its appearance after setting the bottle over the small trap in the table so that it receives heat from the alcohol lamp.

Unfortunately for the medium, he does not always have an audience that is willing to take the manifestations on faith. Some of the people who come to the séances insist on bringing their own slates. The medium takes the slates, which are tied and sealed by skeptics, and has no difficulty in obtaining writing upon them. The result is that it furnishes the most positive proof of spirit power to the unbeliever. Let us suppose that the spectator brings a thoroughly clean slate and holds one end of the slate in one hand and the medium the opposite end, and both persons clasp their disengaged hands. In a short time the slate is turned over and a few words are found written in a scrawling hand. The secret of this phenomenon will be readily understood by referring to Fig. 5. A piece of slate pencil is fastened to a thimble and this is attached to the medium's fore-finger of the same hand which holds the slate. The thimble is fastened to an elastic which goes up the sleeve, so that, the instant the writing is concluded, the thimble is pushed off with one of the fingers and disappears up the medium's sleeve. There is always considerable danger of detection to the medium in using this device; so that the method shown in Fig. 6 is adopted by some mediums. A tiny piece of slate pencil, no bigger than a pencil lead, is placed on the tip of the forefinger, and over it is secured a piece of flesh-colored court plaster. The finger is painted with aniline or other colors, so that the line of demarkation between the court plaster and the flesh is eliminated. After the court plaster has set, a small aperture is made in it, so as to allow the point of the pencil to come through far enough to be able to mark on the slate. The writing is done with this prepared finger. The message must be written backward, so that when the slate is reversed it will appear in its correct position. The message must necessarily be short, on account of the limited distance which the medium's finger can travel.

A Course in Railway Mechanical Engineering.

Cornell University has always been in the lead in the introduction of novel and eminently useful courses, and now one more course has been added. It is called the Graduate School of Railway Mechanical Engineering, and, of course, it comes under the Sibley College of Mechanical Engineering, of which Dr. Thurston is the Director. The school was organized in February, 1898. Its purpose is to concentrate and systematize the work in the mechanical engineering of railway machinery previously constituting a subordinate part of the existing courses, and to offer special instructions to students who have completed a general course in technical institutions of high rank, and, furthermore, to members of the engineering profession desiring special knowledge in this field. For all such, in addition to instruction in this department of engineering, immediate practical value courses of work are also available in other departments of the college and of the university. The courses in the school will have special relation to the design, construction, operation, and maintenance, and the test trials of locomotives and other kinds of machinery employed in railway operation. They will be particularly adapted to the needs of the engineer seeking to find his way into the departments of construction of railways, and ultimately into the positions of superintendent of shops and of motive power. In addition to the courses offered in Sibley College as purely professional, there will be found in the scheme of the special courses leading to advanced degrees opportunities of pursuing work in economics, in law, and in allied professional and scientific departments. The school will so arrange its work as to connect closely with the undergraduate work of Sibley College. Students in the undergraduate courses may begin to specialize in their junior year and to increase considerably this specialization in their senior year. The principal of the school is Prof. H. Wade Hibbard. He has been well known in the railroad world since his graduation from Brown University, thirteen years ago.

FATE OF STERNWHEELERS DESIGNED FOR THE YUKON.

Of the forty sternwheel steamers designed for navigation of the Yukon River and which have attempted the ocean passage, only about eight, or one in five, have been successful. The larger number of these vessels have sailed from Seattle and kept to the inside route, along the coast. Several attempts have been made also from Portland and San Francisco, but with the most disastrous results. The experience almost invariably has been that frail, light draught steamers of this character cannot withstand the great ocean swells, and, in a vast majority of cases, collapse. Fortunately the loss of life in these catastrophes has not been great, as they are always accompanied by an ocean steamer, upon which the passengers in time of danger have been transferred, or else the boats have been so near port as to enable them to return before being completely disabled. There are now about sixty sternwheelers navigating the Yukon, most of which have been constructed in the lower ports, their timbers then being taken apart and carried to St. Michael's and there set up.

The last attempt to sail sternwheelers by the ocean route was made at Astoria, Oregon, some weeks ago, when two, in every respect equal in size and power, started for Alaska, filled with passengers and weighed down with freight. They had been built in Portland and were advertised as being staunch and seaworthy. They were about 125 feet in length and were rated at 300 tons. They were fitted with all the conveniences for travel, electricity, hot water, etc., and each one had over a hundred passengers. They were named the "Game Cock" and "Stag Hound," and cost altogether $125,000. They were accompanied by the steam collier "Elihu Thomson" and left port with every prospect of a fine voyage. It was only a few hours afterward these same steamers returned in the condition shown in the photograph. The great swells off the Columbia River bar had proved fatal. At the first essay both boats were wrecked and were only prevented from sinking by the fact that before starting every particle of space had been utilized for storing wood for the boilers. By great good fortune the two succeeded in reaching port, where they were photographed for the SCIENTIFIC AMERICAN.

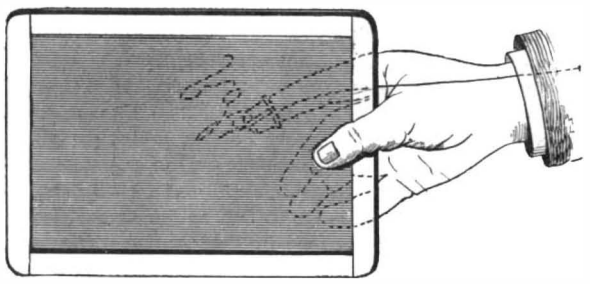
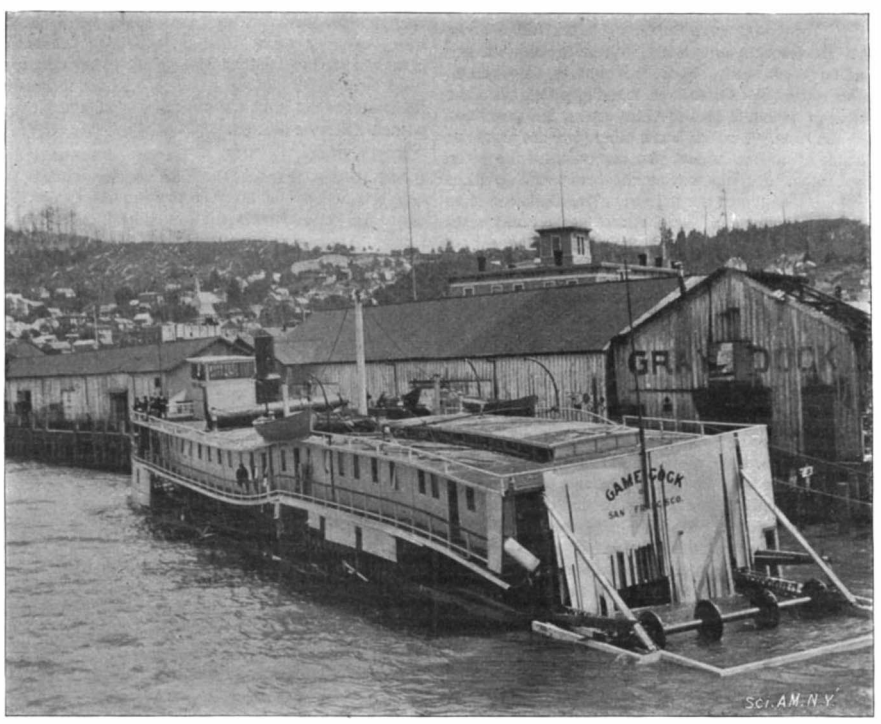


Fig. 5.—WRITING ON THE SLATE WITH THE PENCIL THIMBLE.

Fig. 6.—THE PREPARED FINGER.



STERNWHEEL RIVER STEAMER WRECKED BY GROUND SWELL IN ATTEMPTING OCEAN PASSAGE TO ALASKA.

A Brave Deed.

Few readers are aware that our warships carry boiler makers who are often called upon to perform perilous repairs, and, in cases of emergency, these men go inside of the boiler or furnace, which but a few minutes before had been filled with boiling water or red hot coal. There is no task too dangerous for these men to do. One of them undoubtedly saved the "Castine" from destruction in the harbor of San Juan. The "Castine" went into action under full speed. The furnaces were heated to the highest degree, forced draught being used. Without warning, a fierce hissing noise was heard inside one of the furnaces. A socket bolt in a back connection at the farthest interior extremity of the furnace had become loose, springing a leak. The steam was pouring in upon the fire, threatening in a few minutes to put it out and stop the progress of the vessel, if it did not cause a terrific explosion. All in the boiler room knew that, unless this hole was stopped, disaster was at hand. One of the boiler makers, named Huntley, ordered the forced draught turned off and the fires banked. Taking a plank, he threw it into the furnace on the top of the wet, black coal with which the fire had been banked and then climbed far back to the place where the steam was rushing from the loosened socket. For three minutes he remained inside the furnace. His friends drew him out of the door; the forced draught was turned on, and in a few minutes the ship was proceeding on her way as though nothing had happened. In view of such deeds as this, there is little wonder that the engineering corps in our navy is receiving the highest praise on every side.

THE faintest stars visible to the naked eye are of the sixth magnitude; the faintest telescopic stars are reckoned of the sixteenth or seventeenth magnitude.

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Italian Railways.

The Italian engineer Giuseppe Spera makes in his book, which has lately appeared, some interesting revelations with regard to the Italian railways, and his remarks are worthy of general attention, says The Engineer. Italy possesses a railway system of the value of 140 milliards of lire and 9,334 miles in length, and thereby occupies the eighth place among the countries of the world; but, when one compares the length of the railway system with the number of the inhabitants, Italy is reduced to the forty-first position on this list.

The management of nearly all the Italian lines is in the hands of three companies since 1885, when the state leased the three systems of the Mediterranean, the Adriatic, and the Sicilian railways to the above companies. But, by reason of the shortsighted and bureaucratic nature of the system of management laid down by the state, the development of the railways has been hampered, and as a result of its policy in this respect the sum of £240 has to be granted every year by the state for every kilometer, or about two-thirds of a mile. The time occupied in short journeys leaves much to be desired, and in this matter the Italian railways are in evil plight; this is all the more remarkable since 70 per cent of the passengers make only short distance journeys.

The express trains convey only first and second class passengers, and the passenger trains can at most attain but a speed of from 20 to 23 miles an hour. The passenger rates are certainly not higher than those in use in other countries, but they are much too high in comparison with those current in England, for the population of Italy has scarcely one-fourth of the income enjoyed by the population of England per head. The goods traffic is in an equally bad state; viewed as a whole, the forwarding of goods by rail in Italy is becoming worse and worse, and is far behind the system of conveyance by carriers.

Although the unsatisfactory state of the railways from a commercial point of view may in some degree be traced to the unstable condition of Italian politics, yet the technical shortcomings of the whole system and the unreasonableness displayed in its administration must not be lost sight of; thus, there are from seven to nine officials for every 1,100 yards of railway, while in North America three officials are found to be quite sufficient for the same extent of line. In comparison with other countries, Italy has the largest railway staff. Moreover, the uncertainty and want of security in the goods traffic leave very much to be desired. It is said that matters have come to such a state on the Italian railways that the authorities have resolved to introduce very thorough and drastic reforms.

Travelers have for many years suffered at the hands of the Italian customs officials at the frontier stations, and it is certainly surprising that Italy has been so long in realizing that more attention ought to be paid to the wants of the traveling public, so far as the Italian railways are concerned; year by year new routes are being opened up for the tourist, and the conditions of travel upon such routes are of a nature that for the most part leads one to avoid the discomfort that, as a rule, falls to the lot of the tourist in Italy.

The Current Supplement.

The current SUPPLEMENT, No. 1189, contains a large number of interesting articles and engravings. The first page cut shows the destruction of a balloon 2,000 feet high by means of the new French 7·5-cm. field-piece, and the effect on intrenched infantry of shrapnel fire. "The Chimes of Saint-Germain-l'Auxerrois" describes the most modern form of mechanical bell ringer. "The Electrical Suspension Railroad" is accompanied by a full-page engraving showing the railroad between Elberfeld and Barmen as it will appear when finished. This is an extraordinary development of the elevated railroad, in which the cars are suspended from inverted Y's. "Kangaroo Hunting in Queensland" is illustrated by a spirited engraving showing the hunters in full chase after these animals. "Color Vision," by F. P. Whitman; "The Development of Photography in Astronomy," by Prof. E. E. Barnard, and the "Inaugural Address of Sir William Crookes," are concluded or continued in this number. "Musical Susceptibility of Animals" is an interesting article by Nicolas Pike. Among the technical articles are: "The Dangers of Acetylene," "Black Printing Processes," "Spinning, Stamping, and Working of Aluminum and Brass Sheet," and "Culture and Preparation of Orris Root." "The Neo-Occultism" describes a striking experiment with the X-rays. The column of "Selected Formulæ" is given up in this issue to formulas for the destruction of animal parasites.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

LAWN-MOWER.—HARRY JACKSON, Kingston, N. Y. The purpose of this invention is to provide a lawn-mower in which the knives are so shaped as to obtain the best cutting action, and in which the cut grass will free itself from the machine, thus preventing clogging. In a frame a shaft is mounted carrying blades formed of plain metallic plates. The plates are held diagnally with reference to the shaft, the blade having a tapering flange at its outer edge. This flange is at an angle to the blade and projects beyond one side, running gradually from zero at one extremity to the greatest width of the flange at the opposite extremity. A ledger-knife is held to be engaged by the edge of the knife-flange.

Bicycle Improvements.

UNICYCLE.—VERNON D. VENABLE, Farmville, Va. The unicycle forming the subject of this invention is provided with a rim or spokeless wheel composed of two parts, one sliding upon the other. A seat-support is pivoted upon the inner part of the rim to swing in the plane thereof. A drive-wheel is carried by the inner rim, engages the outer rim and has a limited movement relative to the inner rim. To the inner rim a saddle-post is pivoted and a frame secured. A drive-wheel is adjustably mounted in the frame and has recesses to receive projections on the outer rim. A pedal-shaft is carried by an upright and operates a driving connection between the pedal-shaft and the shaft on which the driving-wheel is mounted.

Electrical Appliances.

ELECTRIC RAILWAY SYSTEM.—GEORGE L. CAMPBELL, Dushore, Pa. This invention is an improvement in electric railway systems, and comprises means by which a closed conduit may be operated. A surface-rail made in short, insulated sections is used, and a trolley or follower within the conduit communicates with a continuous conductor and the third rail or sectional conductor. The car is made to travel by the influence of a magnet mounted on the car. The third rail is normally "dead." The system is hence exceedingly safe, and needs no protection in the way of fences. The workmen employed need take no special care to avoid the rail.

Engineering Improvements.

ROTARY-ENGINE.—JAMES C. WALKER, Waco, Tex. The rotary-engine of this inventor is an improvement on an engine already patented by him. The present engine comprises a fixed annular chamber, a sliding abutment, a drive-shaft having a concentric piston, shaft-operated means for lifting the abutment and a steam-chest for the chamber having a duplex set of steam-ports, one set being at each side of the abutment. A hand-operated sliding valve opens and closes the inlet of one set and the exhaust of the other set of ports. The chest has independently and automatically operated supplemental valves, movable over the inlets and ports. Fixed cams are carried by the shaft to move the supplemental valves in one direction, centrifugal adjustable cut-offs moving them in the reverse direction. Either of the supplemental valves may be set out of engagement with the shaft. Cam and cut off devices hold this valve to close off its respective steam inlets.

ICE-STEAMBOAT.—ANTOINE I. SHERMAN, Punta Gorda, Fla. In this steamboat, improvements in construction are found which enable the boat to be readily handled and navigated on ice or snow, the driving mechanism being operated by steam-power. The boat comprises a frame having adjustable runners thereunder mounted upon vertical pivots, a steering-wheel connected with certain runners whereby they may be used as rudders, and propelling mechanism carried upon the frame and consisting of a rotating wheel having teeth engaging the ice.

Mechanical Devices.

LOCK.—ALFRED L. GARLOUGH, St. Paul, Minn. The lock forming the subject of this invention is of especial value in tenements, offices, and the like, where it is usually necessary, when key-locks are used, to fit new keys for every new tenant. With this lock it is only necessary to change the combination, and thus the expense of new keys is avoided. The lock comprises a casing in which a locking bolt and a latch-bolt are movable. A series of tumbler-carriers are mounted to swing in the casing, and have openings at one side in line with a projection of the locking bolt. Tumblers are adjustable across the openings. The tumbler-carriers may be lifted one independently of the other, the locking and latch-bolts being moved inwardly after the carriers have been lifted. The combinations of the lock may be changed by removing the several carriers.

ALARM MAIL-BOX.—CYRUS R. FUREY, Logansport, Ind. The mail-box provided by this invention is adapted for private use and is an improvement in such boxes as have an alarm attachment, designed to be operated when the lid is opened. The present box has a body with a sounding box in which a gong is located. A wheel is arranged facing and close to the gong, and is provided with a series of curved teeth. A spring has its free end arranged for contact with the teeth, and is provided with a clapper adapted to strike the gong. A rod connects the hinged box-lid with that side of the wheel toward which its teeth are curved, to operate the device on opening the lid.

APPARATUS FOR MANUFACTURING WOOD-ALCOHOL.—MARTIN F. QUINN, Straight, Pa. The main object of this invention is to devise an arrangement so that provision is made for the expansion and contraction of the retort in its housing, without injuring the surrounding brick-work. With this end in view, the inventor places the retort in a housing which has a pier midway of its length and on which the central portion of the retort rests. Two or more other piers are placed on each side of the first-named pier, and on these the retort loosely rests. By this means the retort will contract toward each end from the middle. The discharge-pipes leading the products of distillation from the retort to the condenser are passed through openings in the side of the housing of larger diameter than the pipes. Hence the side walls of the housing, as well as the ends and top, have no connection with the retort, and the housing is not injured by the expansion and contraction of the retort.

TIRE-BOLTING MACHINE.—JOSEPH R. WHITAKER, Wilmington, O. This machine comprises a slotted beam provided at one end with means for securing it to a support and carrying an adjustable hub-pin held in place by a clamping device. A slide is held adjustable on the outer end of the beam and has a post also formed with a bearing, in which a frame is movable that carries a casing at its inner end. Meshing gear-wheels are held in the casing, one of which is provided with a central tapered opening in which a nut-jaw is removably fitted and adapted to engage the nut of a tire-bolt. A shaft is connected with the other gear-wheel and a lever is fulcrumed on the post of the adjustable slide and carries a tool adapted to engage the slot in the head of the bolt.

WOOD-TURNING LATHE.—NELSON R. SPRINGER, Dixfield, Me. The lathe forming the subject of this invention is provided with a movable carriage with which a lever is connected. A toothed bar is adapted to be engaged by the lever to move the carriage forward a predetermined distance. A cutter-head controlled by means of the lever moves in the carriage and is adapted to face off the end of the stick. On the carriage a cutter is fixed for turning the end of the stick round before facing it. The machine is especially adapted to the turning of checkers.

MERRY-GO-ROUND.—WILLIAM HERFURTH, New York city. This merry-go-round comprises principally a revoluble frame having its axis inclined from a vertical plane, and a flexible platform supported freely from the frame to permit the sections thereof to assume a horizontal position by gravity. When the frame revolves then the hobby-horses or other devices always stand in a horizontal position, so that, when the machine is in motion, the hobby-horses incline toward the platform. Thus the rider, carried by one of the hobby-horses, is always in a level position, with a changing floor or platform, so that a spectator gains the impression that the hobby-horse with its rider is moving or rocking.

FRUIT-JUICE EXTRACTOR.—GEORGE N. GUTHRIE, Gallatin, Tenn. The apparatus patented by this inventor is adapted to extract the juice of fruit and comprises a casing, a perforated cylinder having cutters for reducing the fruit to pomace and mounted to rotate in the casing, a screw-shaft extended through the cylinder, and a presser-plate in the cylinder adapted to be moved by the screw-shaft. This machine may be made of any size and will be found useful for household purposes when it is desired to make a small amount of fresh cider and the like.

Miscellaneous Inventions.

METHOD OF AND MEANS FOR DELIVERING PNEUMATICALLY-CONVEYED GRAIN.—FREDERIC E. DUCKHAM, London, England. In conveying grain pneumatically, the grain flows in a somewhat attenuated stream suspended in a current of air of such high pressure that the air and grain travel at a great velocity. The result is that it is well-nigh impossible to deposit the grain in any particular spot if it is projected from the discharge pipe at a high velocity. In the present invention, this objection is overcome by changing the direction of the grain just before it emerges, whereby its high velocity is destroyed. Before the air current can overcome the inertia of the grain and again impart to it its initial high velocity, the air will have become dispersed in the surrounding atmosphere, while the grain, freed from the propulsive action of the air, masses in a thick stream and flows out slowly, so that it may be deposited wherever desired.

DERAILING-DEVICE.—DAVID ANDERSON and DAVID BEVAN, Delphos, O. This device consists of a base adapted to be fastened to a railroad tie, to which base a flange is pivotally connected, having its free end formed with a trough arranged to fit down over the head of the rail. The flange is formed with a diagonal groove commencing at one end at the inside of the trough and below the upper wall thereof and extending over the trough to its outside. An abutment follows the line of the groove on the inside thereof, the upper edge of the abutment being considerably above the upper surface of the free end of the flange above the trough.

SACK-HOLDER.—MONTY A. LYON, Wisdom, Mont. The device provided by this inventor comprises a standard having a central support and side members between which the support is located, and a holder consisting of a band adapted to engage a sack or the like at the mouth and engaging the side members of the standard, the holder being provided with a hook adapted to engage the support. The hook can be readily disengaged whenever desired, to permit the sack to be shaken, after which operation the hook can be again conveniently attached to the support and the filling completed.

WRENCH.—CHARLES S. METCALFE, Silver City, New Mexico. To provide a wrench which will grip either round or polygonal bodies with equal firmness is the purpose of this invention. The shank of the wrench is provided with a fixed jaw and carries an adjustable traveler. A movable jaw is fitted upon the shank and pivotally mounted at its heel upon the traveler. A lever is interposed between the front of the movable jaw and the traveler and fulcrumed on the latter, the lever having a cam-surface in engagement with the movable jaw at the front thereof.

DISCHARGE-VALVE FOR ASH-PITS.—JOSEPH SEDLMAYER, New York city. This invention is an improvement upon a device of a similar nature for which a patent was granted to the same inventor. The chute is provided with hinged wings. A sliding hinge-bolt is also provided, having above its axis a sleeve with a wedge-shaped end adapted to engage the upper surface of the wings to lower or open them. Another sleeve is secured to the bolt below its axis and is provided with a wedge-shaped end adapted to engage the lower surface of the wings to raise or close them.

COIN-CHUTE.—CHARLES J. TAYLOR, Shelbyville, Ill. The chute devised by this inventor is designed more especially to be used in connection with telephone pay-stations. In one side of the casing of the chute are fixed stops one above the other and insulated from one another. A vertically-moving plate is located at the opposite side of the casing and is provided with two stops, one above the other. The two lower stops are in an electric circuit designed to be closed by a coin engaging with the lower stops. The telephone-lever has connection with the movable plate. The movable stops are so related to the fixed stops that when the telephone lever is held downward the two upper stops will retain the coin; when the lever is raised, the coin will be released from the upper stops and caught and held by the two lower stops until the lever is moved downwardly, releasing the coin from the lower stops.

DISH-DRAINER.—HENRY M. TSCHOPP, Pickerington, O. This dish-drying tray has a leg to support its outer portion and has a fastening device or jaw capable of engaging the edge of a pan, whereby to support the inner portion of the tray and permit the dishes to drain into the pan and to dry upon the tray.

TIRE-HOLDER.—JOHN D. AITKEN, Northport, N. Y. The purpose of this invention is to provide a device to support a tire above a blacksmith's anvil so as to carry most of the weight thereof and permit ready manipulation. The support comprises a tube with a series of lateral pin-receiving holes, a bar slidable within the tube and having a side-extending hook upon its lower end, a spring attached to the upper end of the bar, and a pin adapted to pass through the holes in the tube and engage the upper end of the spring.

ACETYLENE GAS-GENERATOR.—GEORGE L. HOGAN, Baltimore, Md. This acetylene gas generator belongs to that type in which an external tank, holding water, is combined with an inverted bell or buoyant gasometer dipping down into the water at its lower edge and containing a basket for the calcium carbid. The gasometer, on being raised out of the water by the pressure of the gas, carries the carbid out of contact with the water and thus stops further generation until the gas already generated has been consumed. The present invention adapts this form of generator for use as a street-lamp and for other large lamps.

TOBACCO PIPE—THOMAS MCE. GILL, Mexico, Mo. This invention seeks to do away with the varnish and filling or other polished finish commonly used on cob and wood pipes, which varnish often destroys the desirable qualities of a pipe. To secure a fine external finish and shape which will permit the thorough cleaning and ready renewal of the bowl or lining of the pipe, which will at the same time form an air-chamber surrounding the lining to prevent the exterior of the pipe from being overheated and which will permit the convenient adjustment of the casing to take up shrinkage from time to time as may be desired, the pipe forming the subject of the present invention has been devised. The inventor also secures such results by a special construction of casing which serves to form an ornamental exterior and which strengthens the material.

Designs.

COMBINATION GARMENT.—JACOB H. FLEISCH, New York city. This garment is a combination coat and waistcoat, and constitutes a desirable sporting costume. To the flaps of a coat waistcoat flaps are secured, which, when buttoned, present the appearance of a waistcoat beneath a coat.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of the invention, and date of this paper.

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NEW BOOKS, ETC.

WIRELESS TELEGRAPHY POPULARLY EXPLAINED. By Richard Kerr. With preface by W. H. Preece. New York: Imported by Charles Scribner's Sons. 1898. Pp. 111. Price 75 cents.

In the last two years considerable interest has been manifested in wireless telegraphy, and, so far as we know, this is the first book upon the subject. The experiments of James B. Lindsay, Mr. Preece, Marconi, and Dr. Lodge are given concisely, but the book is confessedly intended for popular use.

HANDBUCH DER BAUSTOFFLEHRE. Bearbeitet von Richard Krüger. Two volumes with 443 illustrations. Vienna: A. Hartleben. Large octavo. Pp. 887. Price, paper $8.

Within the last fifteen years artificial building materials have become so numerous and have found so wide an application that a book in which they are discussed in detail should be welcomed. In the work now lying before us, the author, besides describing the natural materials used in building, such as stone, wood, and the like, also treats of those important artificial substances now so generally employed. In describing the various building stones and woods, the author has made use of his own experience and of the tests made by the German government at its various experiment stations. The book is divided into three sections. In the first section, the natural and artificial stones, the earths and metals are discussed. The second section treats of the various mortars, asphaltum, and cement. The third section deals with the making and use of glass, resin, tar, paints, varnishes, caoutchouc, guttapercha, oiled cloths, asbestos fabrics, carpets, ropes, hemp, and moss. In order to facilitate the use of his work, the author has compiled an exhaustive index of the subjects discussed. The book will be a desirable acquisition to the libraries of architects, engineers, and manufacturers of building materials.

BUILDING CONSTRUCTION AND SUPERINTENDENCE. By F. E. Kidder. Part II. Carpenter's Work. New York: William T. Comstock. 1898. Pp. 544. 524 illustrations. 8vo, cloth. Price $4.

Mr. Kidder has long been known to the manufacturing profession through his "Architect's and Builder's Pocket-book," and in the present volume he deals with the materials employed by the carpenter and joiner, more especially with the details of all forms of wooden construction, from the rough framing of wooden buildings to nicely finished cabinet wood. The work is in every sense what may be called a practical one, while at the same time the reasons for, and advantages of better systems of construction are intelligently pointed out, and also the defects of cheaper and more common forms. The book will not only be of value to the carpenter, but will be simply invaluable to the architect. With the aid of clear sections of windows, doors, etc., the architect will not have to spend much time thinking out the proper arrangement of stops, stiles, etc. He will only have to refer to this book to find a large scale section which will give him just the information he wants with the dimensions lettered upon it. Hardware of all kinds is described, and the proper method of applying it is shown. It is one of the most valuable books which ever appeared on the subject in this country and we have no hesitation in recommending it.

THE AMERICAN STREET RAILWAY DIRECTORY AND BUYERS' MANUAL. New York and Chicago: E. L. Powers. 1898. Published quarterly. Price $3 per annum.

This directory contains a complete list of electric, cable, horse and elevated railways in the United States, with the capital, bonds, names of the officials, mileage, gage of the track, number of cars, power plant, names of the makers of the generators, engines and boilers, etc. It also contains some valuable statistics of the worth, mileage, capitalization, and car equipment of street railways in the United States, from which we find that there are at present 909 electric roads out of the 1,074 roads which exist in the United States. In other words, there are at present over eight times as many electric roads as horse roads, and only twenty-one cable roads are now in operation in the entire country. The capital stock of these 1,074 roads amounts to $975,625,827, and the bonds amounts to $1,527,970,220, the total mileage 16,466·78, and there are 48,209 cars in use.

POOR'S MANUAL OF THE RAILROADS OF THE UNITED STATES FOR 1898. Thirty-first Annual Number. New York: H. V. & H. W. Poor. 1898. 8vo. Pp. 1,600. 70 maps. Price $7.50.

Poor's Manual is always a welcome visitor. It is simply invaluable to all who are engaged in any part of the railroad world. All who are in any way interested in securities will find the book indispensable. Each railroad is taken up in turn. The mileage of all main lines, branch, and leased roads are then given, and in the case of leased lines the annual charge is given. Then comes the history of the road, a detailed account of its rolling stock, floating equipment, operations for the year, capital stock, bonds, equipment trusts, etc. Then comes full information regarding leased roads. From this it will be seen that the book contains information of such a wide range that it is simply invaluable to all who are interested in any way in railroads. The total mileage of railroads of the United States at the end of 1897 was 179,692·57 miles. The total length of track was 236,911·52 miles. There were also 35,810 locomotive engines, 25,275 passenger cars, 8,133 mail cars, etc., and 1,229,335 freight cars. Total liabilities of the various roads amounted to $11,631,711,740. The number of passengers carried was 504,106,525, and 788,385,448 tons of freight were moved. There are a number of pages with just such statistics which are of importance from an economic point of view. In addition to steam roads, street railways, and miscellaneous corporations, there is also a department of State and municipal indebtedness. The book is well printed and contains a perfect mine of information.

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"Model Engineer and Amateur Electrician," a first-class paper, published every month. Annual subscription, 75c. Send 8c. for sample number. Agents wanted. Spon & Chamberlain, 12 Cortlandt St., New York, U. S. A.

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References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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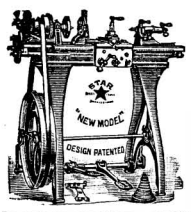
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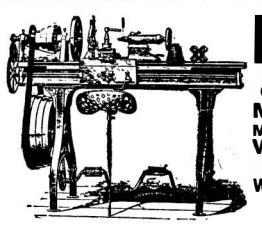
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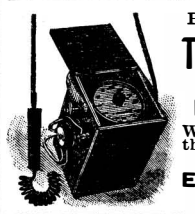
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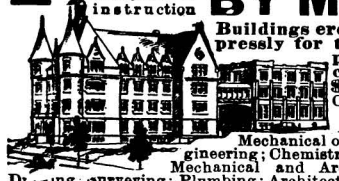

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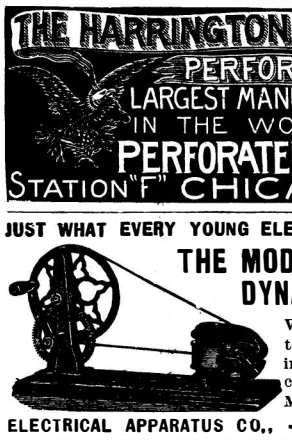

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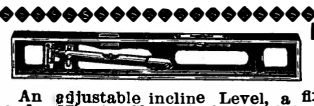

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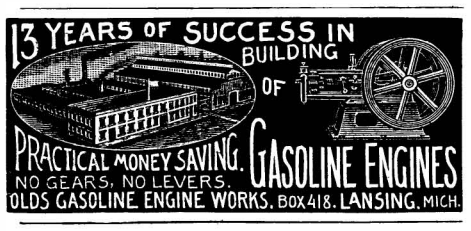
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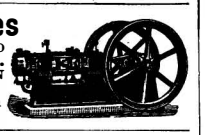

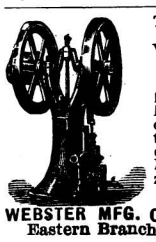

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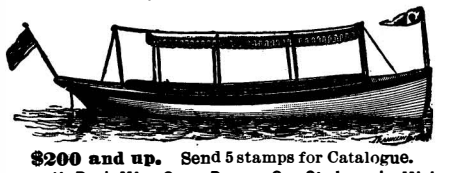

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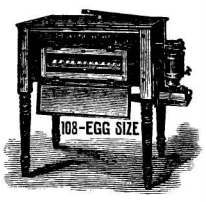

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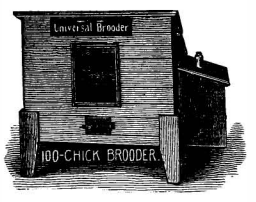

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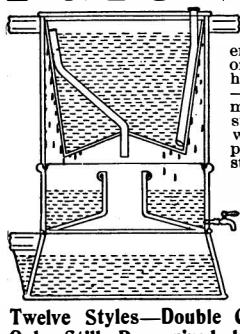

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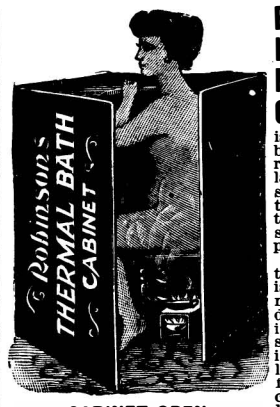

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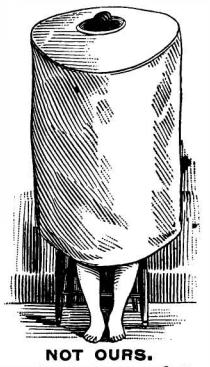

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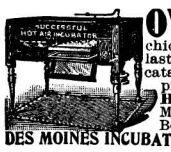

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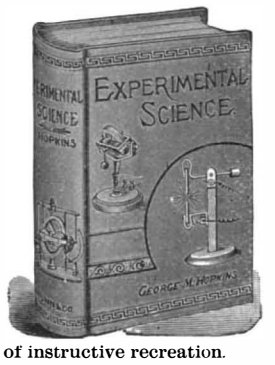

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